VOLUME 16 NUMBER 12

NUTRITION REVIEWS

December 1958

Cell Enzymes and Iron Metabolism in Anemias and Siderosis, by Theodore Gillman 353

Author Index 356

Subject Index 363

Published Monthly at Mt. Royal and Guilford Aves., Baltimore 2, Md.

for

THE NUTRITION FOUNDATION, INC.

99 PARK AVE. NEW YORK 16, N. Y.

COPYRIGHT, 1958, NUTRITION FOUNDATION INC., NEW YORK, U. S. A.

Editor

FREDRICK J. STARE, PH.D., M.D., Professor of Nutrition, Schools of Medicine and Public Health, Harvard University; Associate in Medicine, Peter Bent Brigham Hospital, Boston. Editorial Office, One Shattuck Street, Boston, Mass.

Assistant Editor

JEAN M. HOEGGER, One Shattuck Street, Boston.

Associate Editors

WILLIAM E. ABBOTT, M.D., University Hospitals of Cleveland.
WILLIAM H. DAUGHADAY, M.D., School of Medicine, Washington University, St. Louis.
R. W. ENGEL, PH.D., Department of Biochemistry and Nutrition, Virginia Polytechnic Institute, Blacksburg.
ALFRED E. HARPER, PH.D., Department of Biochemistry, College of Agriculture, University of Wisconsin, Madison.
JAMES F. MEAD, PH.D., Department of Physiological Chemistry, School of Medicine, University of California, Los Angeles.
OLAF MICKELSEN, PH.D., Laboratory of Biochemistry and Nutrition, National Institute of Arthritis and Metabolic Diseases, Bethesda.
OLOF H. PEARSON, M.D., Sloan-Kettering Institute, Memorial Center, Cornell University Medical College, New York.
WILLIAM J. PYLES, M.D., Department of Medicine, St. Luke's Hospital, New York.
JAMES H. SHAW, PH.D., Schools of Dental Medicine and Public Health, Harvard University, Boston.
ELMER H. STOTZ, PH.D., Department of Biochemistry, School of Medicine, University of Rochester.
ROBERT W. WISSLER, PH.D., M.D., Department of Pathology, University of Chicago.
CALVIN W. WOODRUFF, M.D., Department of Pediatrics, Vanderbilt University Medical School, Nashville.

Editorial Committee

WALLACE R. AYKROYD, M.D., Food and Agriculture Organization
GEORGE R. COWGILL, PH.D., Yale University
CHARLES S. DAVIDSON, M.D., Boston City Hospital
CONRAD A. ELVEHJEM, PH.D., University of Wisconsin
IAGO GALDSTON, M.D., New York Academy of Medicine
WENDELL H. GRIFFITH, PH.D., University of California
CHARLES GLEN KING, PH.D., Nutrition Foundation
BERWYN F. MATTISON, M.D., American Public Health Association
L. A. MAYNARD, PH.D., Cornell University
HAZEL STIEBELING, PH.D., Institute of Home Economics
LEROY VORIS, PH.D., National Research Council
WARREN WEAVER, PH.D., Rockefeller Foundation
JOHN B. YOUMANS, M.D., Vanderbilt University

Subscriptions should be sent to The Nutrition Foundation, Inc., 99 Park Ave., New York 16, N.Y.
Rate $4.00 per year in the United States and Canada; $4.50 in other countries.
Changes of address should be sent to The Nutrition Foundation.
Second-class postage paid at Baltimore, Md.

Note: Items may be quoted from NUTRITION REVIEWS without special permission. If quotations are made, the editors ask only that credit be given to NUTRITION REVIEWS and that they be made in such way that the original meaning of the review is preserved.

NUTRITION REVIEWS

VOL. 16 DECEMBER 1958 No. 12

CELL ENZYMES AND IRON METABOLISM IN ANEMIAS AND SIDEROSIS

From many recent studies (thoroughly reviewed by Josephs in *Blood* **13,** *1 (1958)*), as well as from Beutler's excellent work (*Nutrition Reviews* **16,** *157 (1958)*), it appears that the prevailing concepts underlying studies of iron metabolism are not clearly understood despite the great number of investigators presently working in this field and the delicate techniques now available.

As remarked (*Nutrition Reviews, loc. cit.*) "Beutler has (indeed) opened up a whole new vista of objective clinical experimentation. . . ." Without wishing to detract in any way from Beutler's fine contributions, it should be noted that for many years there have been strong indications that the approach pioneered by Beutler was long overdue. Indeed, it seems strange that although so much information is available about the half-life of hemoglobin molecules, nothing, to my knowledge, is known about the rate of turnover of the various intracellular iron-containing enzymes.

All are aware that red cell precursors have a peculiar affinity for iron and the avidity of these cells for this metal has been shown to decrease as they mature (*Lancet* **II,** *727 (1957)*). These simple facts alone might have been taken to indicate, as they obviously do, that the need for and utilization of iron varies in different cells in health, and that these needs and uses might be expected to change in various physiological and pathological conditions, thus altering iron metabolism generally. Moreover, entry of iron into cells and its use are not passive processes but are functions of the integrated activity of a number of cell enzymes (*J. Biol. Chem.* **214,** *657 (1955)*; **220,** *741, 751, 777 (1956)*; *Biochim. Biophys. Acta.* **26,** *441 (1957)*). Consequently, it is not unexpected that Tappan *et al.* (*Am. J. Physiol.* **190,** *93, 99 (1957)*) demonstrated, in animals acclimatized to high altitudes, increases in both skeletal myoglobin and intracellular iron-containing enzymes in many tissues.

The above data and those of Beutler suggest that the rate of iron turnover within many cells may be considerable. Perhaps it is within the small yet important non-hemoglobin compartment of bodily iron, comprising cell enzymes, that the basic regulators of iron uptake may yet be found to lie; even short periods of hypoxia rapidly promote alterations in circulating transferrin, erythropoietin and serum iron. Moreover, it has been demonstrated (*Exp. Med. Surg.* **15,** *176 (1957)*; *Am. J. Physiol.* **191,** *113 (1957)*) that the effects of short periods of hypoxia on erythropoietin serum iron, may last for three to five days after a single exposure. The possibility that erythropoietin influences cellular iron metabolism directly (and possibly, therefore, iron absorption indirectly) receives support from the recent demonstration (*Nature* **181,** *1537 (1958)*) of two- to seven-fold increases in iron uptake by bone marrow cells exposed *in vitro* to anemic serum known to contain erythropoietin. Moreover, Smith *et al.* (*Proc. Soc. Exp. Biol. Med.* **94,** *656 (1957)*) found a marked increase in the uptake of a single standard dose of radio-iron in rats immediately after exposure to simulated high altitudes for only two hours, and long before any change in hemoglobin could be expected.

Using these facts we have conducted experiments, the preliminary results of which indicate that the intense siderosis, inducible in rats fed an iron-enriched maize diet (*Lancet, in press (1958)*) can be increased markedly by exposing these animals to simulated high altitudes for approximately one hour sessions thrice weekly, an effect

not thus far detectable in rats fed an iron-enriched stock ration with equal calcium and phosphorus content.

Various types of malnutrition may perhaps exert different effects on iron metabolism and not, as presently held, simply by virtue of the excess or deficiency of dietary iron. The diet of the Union of South African seems to promote severe siderosis due apparently to some cellular metabolic change(s) induced by such diets, and not to iron overload alone ("Perspectives in Human Malnutrition", Gillman and Gillman, Grune and Stratton, New York (1951); Gillman, Hathorn and Canham, *Lancet, in press*). Thus, rats fed an iron-enriched stock diet were found to ingest almost twice as much iron daily as those fed an iron-enriched maize diet. Yet the latter animals absorbed far more iron and developed marked hepatic siderosis, detectable histochemically and confirmed chemically by the five-fold greater iron content of their livers. In these animals, as in the African, excessive iron was first found within the hepatic epithelium and only subsequently did the phagocytes become siderotic. These findings conform with those of Gillman and Gillman (*Nature* **154,** *148 (1944)*) who found that, in the early stages of human nutritional siderosis, histochemically demonstrable iron, first encountered on or around the hepatic cell mitochondria, was apparently derived from the degradation of iron-containing enzymes located within these organelles. The recent confirmation of this finding and opinion by Richter's electron-microscope studies (*J. Exp. Med.* **106,** *203 (1957)*) is indeed gratifying, and adds weight to the possible contribution of intracellular enzymes to cellular and to total body iron.

Perhaps nutritional microcytic anemias are also due to deranged *cellular* metabolism induced by diet. Hitherto, such anemias have been attributed mainly to an alleged iron deficiency, simply because iron therapy promotes improvement. The fallacies in this type of logic have been analysed critically by Gillman and Gillman (*op. cit.*) who then suggested that clean-cut evidence of "true deficiency" of dietary iron, as the cause of such microcytic anemias, was lacking. This view now receives support from Foy and Kondi's recent statements (*J. Trop. Med.* **60,** *105 (1957)*; *Tr. Roy. Soc. Trop. Med. Hyg.* **52,** *46 (1958)*) that the diets of people suffering from microcytic anemias contain a daily average of 30 mgm. of iron. Could not yet another type of alteration in cellular metabolism, imposed by a grossly inadequate diet, lead to decreased "needs" for both cellular iron and hemoglobin and hence to decreased absorption, even when this metal is available, just as the siderotic African's diet promotes excessive absorption? This possibility certainly seems to be substantiated by another observation of Foy and Kondi (*Nutrition Reviews* **15,** *294 (1957)*) that, even on such so called iron-deficient diets, hemoglobin synthesis is apparently improved by the metabolic changes at high altitudes.

It also seems interesting to note that, in two separate series of liver biopsies, we found hepatic siderosis to be frequent in megaloblastic anemias, occurring among peoples consuming so-called iron deficient diets. Hepatocellular siderosis has long been known to occur in pernicious anemia and was usually attributed to hemolysis. However, Gillman and Gillman (*op. cit., p. 343*) adduced evidence in support of their suggestion that iron, in this anemia as in nutritional siderosis, was derived from the disruption of intracellular iron-containing enzymes and not from hemoglobin. This siderosis may be yet another manifestation of the widespread cellular metabolic upsets now known to occur in megaloblastic anemias (*Am. J. Med. Sci.* **227,** *481 (1954)*; *J. Lab. Clin. Med.* **43,** *235 (1954)*; *Lancet* **I,** *830 (1958)*). This contention also has to recommend it, its conformity with Sheldon's view ("Haemochromatosis", Oxford Univ. Press (1935)), that in hemochromatosis too epithelial iron is derived not from hemo-

globin but from the affected cells themselves as a result of some genetically determined cellular metabolic abnormality.

Thus, the body's capacity to absorb and use iron can be made to vary at least by bleeding animals (or men), by exposing them to hypoxia and by feeding them different diets. It has also been held that the increased absorption of iron, induced by the above procedures, is simply a reflection of the state of the body's stores. However, this view is probably only partially true. Since it has been shown that maize diets increase iron uptake, may it not be possible that other diets *suppress* iron absorption through the alterations in cellular metabolism they promote? Can the excessive or depressed iron uptake, on certain types of inadequate diet, perhaps be secondary to basic change(s) in cellular metabolism and also in endocrine functions induced by these diets?

Symptoms attributed to "iron deficiency" are known to occur with or without anemia and, with iron therapy, these symptoms as well as achlorhydria may resolve before or even without associated changes in hemoglobin. Perhaps the efficacy of iron, administered therapeutically, may be attributable not simply to "replacement therapy" but rather to the overall improvement, induced by iron, in the utilization of the other components of the diet. The latter possibility is certainly supported by the demonstration of Pommerenke, *et al.*, almost a quarter of a century ago (*J. Exp. Med.* **61,** *261, 283 (1935)*) that iron has a marked catalytic effect on protein synthesis throughout the body; quantitative changes in circulating transferrin, produced by iron ingestion, have also been noted recently (*J. Lab. Clin. Med.* **48,** *926 (1956)*).

Thus, a considerable body of indirect evidence is already available indicating the need, in the field of iron metabolism, for further studies of cellular enzymes such as those pioneered by Beutler. In these studies the affects of hypoxia and of diet in modifying iron-containing enzymes, and thereby iron uptake and utilization throughout the body, will undoubtedly find an important place as will the role of the endocrines.

Understanding the mode of endocrine action on cells, may, in turn, elucidate the unique effects of thyroid and other hormones on intrinsic causes other than infections and hypersplenism. This is apparent from the iron-resistant anemias in hypothyroidism (*Acta med. Scandinav.* **89,** *526 (1936)*; *Am. J. Med.* **24,** *535 (1958)*). The recently disclosed action of androgen on resistant anemias, with the production of red cells even beyond the normal range, is illuminating in this regard. This latter response has been previously ascribed only to anoxia and cobalt, both probably operating through some action(s) on cells (*Brit. Med. J.* **2,** *422 (1957)*). The role of endocrine derangements in malnourished individuals should also be taken into account in explaining the iron metabolism, in anemias or siderosis, in malnourished peoples. This is indicated by the disturbed androgen/estrogen balance and the frequency of signs of hypothyroidism in malnutrition (Gillman and Gillman, *op. cit., Ch. 25*). Drabkin's conviction that thyroxin acts in close collaboration with cytochrome C seems significant for the present argument (*J. Biol. Chem.* **182,** *235 (1950)*).

It is hoped that the above analysis may expedite the adoption of a conceptual approach permitting an early resolution of many puzzling features of iron metabolism through a broader understanding of the reactivity of intracellular iron-containing enzymes under a variety of circumstances.

THEODORE GILLMAN, D.Sc., M.D., B.Ch.
University of Natal
Durban, South Africa

AUTHOR INDEX

The letters SA preceding the page number designate authors of special signed articles; the letter B designates authors of books which are listed by title in the Notes Section; LE refers to "Letters to the Editor"; N refers to articles in the Notes Section.

Names beginning with Mc are indexed before those beginning with Ma.

Aaes-Jorgensen, E., 59
Abadi, D. Mohammad-, 242
Abels, J., 307
Adam, D. J. D., 10
Addis, T., 183, 337
Adelove, W. A., 177
Adlersberg, D., 247
Ahrens, E. H., Jr., SA65, 80, 83, 89
Albanese, A. A., 132
Albert, A., 179
Albert, S., 86
Albright, F., 247
Alfin-Slater, R. B., 59
Allcroft, R., 78
Allen, A., 152
Allen, E., 296
Allen, J. G., 164
Allison, J. B., SA65, 285, 313
Allred, J. B., 108
Almquist, J. H., 242
Alpen, E. L., 48
Anderson, C. W., 242
Anderson, E. C., 153
Anderson, J. T., 42, 77, 247, 285
Anderson, L. G., 147
Andersson, B., 302
Andrews, M. M., 167, 281
Andrus, S. B., 140
Anliker, J., 58
Ansell, B. M., 71
Anslow, W. P., 178
Antonis, A., 83
Arai, T., 336
Archer, H. D., 75
Aronovitch, J., 230
Arscott, G. H., LE32
Asper, S. T., 283
Atkins, H. J. B., 261, 342
Aub, J. C., 269
Augar, V., 331
Axelrod, A. E., 305

Baglioni, C., 312
Bain, J. A., SA161
Bain, K., N351
Baker, H., 230
Baker, K., 39
Baliga, B. P., 344
Banerji, G. G., 126
Barboriak, J. J., 305, 350
Barki, V. H., 284
Barr, D. P., 263
Barrentine, B. F., 300
Bartner, E., 342
Bass, D. E., 237
Bassett, S. H., 269
Bauer, F. K., 71
Bauer, W., 269
Baumann, C. A., 337
Bazemore, A., SA161
Beal, V. A., 67, 191
Bearn, A. G., 39
Beath, O. A., 174
Beatty, C. H., 312
Bectol, C. O., 295
Béhar, M., 259
Belanger, L. F., 277
Bencosme, S. A., 60
Bennett, B. A., 344
Bennetts, H. W., 78
Benton, D. A., 112
Bergman, M., 105
Berlin, N. I., 14
Berryman, G. H., 77
Berson, S. A., 283
Bessey, O. A., 10, SA65, SA161
Best, C. H., 87
Best, M. M., 331
Bethard, W. F., 251
Beutler, E., 155
Bevans, M., 25
Beveridge, J. M. R., 68
Bhatia, D. S., 80
Bickel, H., SA257
Bieri, G., 174
Bierman, E. L., 102, 135
Binkley, F., 178
Bishopric, G. A., 179
Bland, W. H., 71
Blankenhorn, D. H., 83, 89, 191
Blaschko, H., 178
Block, S., 137
Boda, J. M., 141, 300
Bogdanski, D. F., 85
Bohstedt, G., 242
Boles, R. S., Jr., 269
Bongiovanni, A. M., 323
Boorman, K. E., 261
Booth, A. N., 181
Borchers, R., 242
Borgstrom, B., 348
Bornstein, J., 167
Borsook, H., 29
Boxer, G. E., 231
Boyle, D., 7
Bozian, R. C., 164
Bradley, J. E., 113
Bradley, S. E., 39
Brady, R. O., 152
Brandt, J. L., 298
Brennan, R., 295
Bridgforth, E., 6
Briggs, G. M., 174
Briggs, H. M., 299
Brill, G., 230
Brock, J. F., 36, 83, 131, 186
Broh-Kahn, R. H., 137
Bronte-Stewart, B., 83
Broquist, H. P., 116, N128
Brosin, H. W., SA97
Brown, L. R., 300
Brown, R. E., 115
Brownell, G. L., 269
Browning, J. R., 60
Brozek, J., 77, SA257
Bruno, D., 83, 344
Bryant, F. J., 315
Bujard, E. 344
Bulatao E., 7
Burchell, H. B., 90
Burchenal, J. H., 248
Burke, B. S., SA1, 326
Burney, L. E., SA225
Burr, G. O., 89, 284
Buse, J., 177
Buskirk, E. R., 237

Cahill, G. F., 60
Calhoun, J. A., 89
Calvary, E. C., 164
Campbell, B., 261
Campbell, I. R., 23
Campbell, J. A. H., 36, 331
Cannon, P. R., 155, 313
Carlson, A. J., 7
Carpenter, K. J., 344
Carroll, K. K., 81, 246, 331
Cartwright, K. L., LE319
Cass, J. S., 23

Castleman, L., 298
Caul, J. F., SA257
Cavallini, D., 82
Chaikoff, I. L., 25, 131, 152, 172
Chalmers, T. C., 37, 73
Chamberlain, A. C., 315
Chanda, R., 44
Chang, R. S., SA321
Chase, H. C., 117
Cheng, A. L. S., 331
Cherkes, A., 102
Chernick, S. S., 149
Cheung, M. W., 5
Cholak, J., 23
Chow, A. Y., 44
Chow, B. F., 307
Chrisman, O. D., 295
Christensen, F., 25, 284
Christensen, G. M., 178
Christensen, H. N., 39
Chudzik, E. B., 179
Clark, C. T., 85
Clark, R., 300
Clarke, D. A., 248
Clarke, N. E., 89
Clayton, C. G., 307
Cleland, J. B., SA129
Clement, G., 186
Clement, J., 186
Cleveland, A. S., 329
Coates, M. E., 307
Coelho, R. O., 295
Cogan, D. G., 121
Colcher, H., 247
Cole, H. H., 300
Collazos, C. C., 267
Collins, H. A., 317
Colvin, H. W., Jr., 300
Comar, C. L., 153, 277, 315
Concepcion, I., 44
Connell, W. F., 68
Consolazio, C. F., 77
Constant, M. A., 181
Cook, A. C., 300
Cooke, R. C., 240
Coon, M. J., N127
Cori, C. F., 60
Cornfeld, D., 240
Corrigan, H., 269
Costello, R. L., 25
Coursin, D. B., 10, SA161, 231
Cowgill, G. R., 140, 305, 350
Cox, A. J., 315
Coy, N. H., 342
Coyne, B. A., 39
Craig, J. W., 70
Cramond, B., 44
Crawford, J. D., 247
Creditor, M. C., 164
Crohn, B. B., 60
Cummings, J. N., 37
Cunningham, I. J., 78
Curran, G. L., 25

Daft, F. S., 149
Dahl, L. K., SA1
Dakroury, A. M., 334, 344
Dam, H., 25, 89, 113, 149, 284
Darby, W. J., 6
Darrow, D. C., SA65
DaSilva, A. C., 140
Datta, S. P., 178
Dauben, W. G., 131
Davidson, N. W., 164
Davidson, W. S., SA129
Davis, C. M., 77
Davis, R. A., 240
Davis, R. E., 300
Dawber, T. R., SA1
Dawson, R. M. C., SA161
Day, H. G., 117
Day, P. L., 113
Dean, F. R. A., SA257
Decker, G. C., SA289
Dee, R. L., 44
DeEds, F., 315
de Langen, C. O., 159, 274
DeMarco, C., 82
Dent, C. E., 178, 247
Deshpande, P., 325
Deuel, H. J., Jr., 59, 331
de Vries, A., 48
Dick, A. T., 78
Dinning, J. S., 113
Dinziz, R., 185
Dobson, D. C., 113
Dodd, B. E., 261
Dole, V. P., 102, 135, 292
Dolger, H. P., 230
Doll, R., SA129
Donath, W. F., 159, 274
Doolan, P. D., 48
Dormer, A. E., 75
Dougherty, R. W., 300
Douglass, J. W. B., 261
Drachman, S. R., 247
Dragstedt, L. R., 60
Dreiling, D. A., 102
Dreisbach, L. S., 334
Drucker, W. R., 70
Dubach, R., SA65, 113, 170
Duetsch, H. F., 342
Dugal, L. P., 188
Duncan, C. H., 331
Duncan, C. W., 173
du Vigneaud, V., 178

Eades, C. H., 281
Eagle, H., 95, 125, 157, SA321
Eales, L., 83, 131, 186
Earle, A. S., 60
Earle, I. I., 342
Ebstein, W., 167
Ecklemann, W. R., 153
Edman, M., 188
Edwards, C., SA161
Edwards, J. E., 90
Eeg-Larsen, N148
Egli, R. H., 344
Egnund, K. M., 148
Ehrlich, P., 92
Eisenbud, M., 315
Eldred, N. R., 50
Eliel, L. P., 248
Ellinger, G. M., 344
Ellis, W. C., 115
Ellison, E. H., 60
Elvehjem, C. A., 112, 181, 313, 344
Enebo, L., 147
Engel, F. L., 296
Engle, R. L., 39, 284
Englesberg, E., 21
Epstein, F. H., 269
Ershoff, B. H., 188
Esplin, A. L., 299
Evans, H. M., 245

Fainer, D., 266
Fancher, J. A., 164
Fasella, P., 312
Feinstein, A. R., 292
Fenn, W. O., 71
Ferdo, S., 242
Festenstein, G. N., 16
Fieger, E. A., 116
Fillerup, D. L., 348
Fink, H., 22
Finlayson, J. S., 337
Fischer, F. W., 263
Fisher, H., 242, SA321
Fisher, J. H., 39
Fletcher, D. W., 300
Flick, D. F., 188
Flink, E. B., SA65
Florey, H. W., 307
Fodden, J. F., 60
Follis, R. H., 269
Foltz, C. M., 149

Forbes, A. L., 164
Forbes, R. M., 115, 299
Fowler, D. I., 5
Foy, H., 330
Frank, S., 99
Frankland, M., 8
Fredrickson, D. S., SA65
Freedman, L. R., 269
Freeman, A. E., 95, 125
Freeman, S., 329
French, J. M., 234
Froom, S. M., 62
Fry, E. G., 185
Fry, R. E., 108
Fujita, A., SA161
Fujiwara, M., 336
Funca, M., N351
Futcher, P. H., 296

Garner, G. B., 115
Garrett, N. H., 179
Garrigus, U. S., 299
Gasster, M., 307
Gaston, B. H., 164
Gaston, E. A., SA1
Gates, H., 102
Gaudaitis, A., 231
Geber, M., SA257
Gemzell, C. A., 253
Gerrard, J., SA257
Gershoff, S. N., 140
Gey, G. O., SA321
Geyer, R. P., SA321
Geiger, E., 334
Gilbert, C., 145
Gilbert, G. J., 302
Gillman, J., 145
Gillman, T., SA353
Gillum, H. L., 331
Girdwood, R. H., 164
Gitlin, D., 37
Glascock, R. F., 152
Glover, J., 16
Glover, M., 16
Goettsch, M., 71
Gokso, V., N351
Goldberg, L., 39
Goldberger, J., SA257
Goldsmith, G. A., 231
Goldstein, L., 105
Gomez, F. S., 99, SA257
Goodhart, R. S., 231
Gopalan, C., SA129
Gorbman, A., 52
Gordillo, G., 99
Gordon, H., 131, 186
Gordon, R. S., 102
Gorten, M. K., 113
Goto, Y., 273
Graham, A. F., 304
Granados, H., 28
Green, N., 344
Greenbaum, A. L., 152
Greenberg, D. M., 181
Greenberg, L. A., 167
Greenberg, S. I., 59 81 89
Greenberg, S. M., 113, 284
Greene, R. D., 342
Greipel, M., 7
Gross, M., 167
Grossowicz, N., 230
Gruehl, H. L., 342
Gruelich, W. W., 101
Grumbach, M. M., 52
Gubler, C. J., SA65
Gundersen, K., 177
Gunther, M., 261
Gupta, J. D., 334, 344
Gurd, F. R. N., 263
Gurin, S., 152
Guthneck, B. S., 344

Haavaldsen, R., 148
Haber, C., SA161
Hall, P. F., 52
Halsted, J. A., 307
Halver, J. E., 106
Ham, W. E., 242
Hamil, B. M., 44
Hamilton, L. D., 248
Hanel, H. K., 25
Hansen, H. A., 10
Hansen, R. G., 342
Hardy, E. P., Jr., 315
Hargreaves, A., 330
Harley, J. H., 315
Harper, A. E., 313, 334, 344
Harper, C., 247
Harper, H. A., 48
Harris, H., 39, 178
Harris, J., 82
Harrison, H. C., 39, 247
Harrison, H. E., 39, 247
Harrison, T. R., 89
Hart, E. B., 181, 331
Hartroft, W. S., SA65, 87, 347
Haslup, A. L., 296
Hassan, F., 261
Hastings, A. B., 281
Hatfield, E. E., 299
Haurowitz, F., N351
Hawkins, C. F., 234
Hawkins, J. E., Jr., SA161
Hayashi, T., SA161
Haynes, E. G., 44
Hayward, J. W., 242
Heaney, R. P., 248
Heath, C., 264
Heerhaber, I., 145
Hegsted, D. M., 140, 267, 307
Heller, V. G., 299
Heming, A. E., 113
Henderson, L. M., 313
Henneman, P. H., 247
Henriques, O. B., 29
Henriques, S. B., 29
Henry, K. M., 115
Herald, E., 22
Herbst, E. J., 190
Herndon, R. F., 329
Hickmans, E. M., SA257
Higgins, G. M., 90
Higgons, R. A., 132
Hill, A. B., SA129
Hill, F. W., 113
Hipsley, E. H., SA129
Hirsch, J., 81, 89
Hoar, C. S., 60
Hock, A., 22
Hoffbauer, F. W., 298
Hogan, A. G., 181
Holdsworth, E. S., 307
Hollman, E. T., 181
Holman, R. T., SA33, 59, 81, 89, 284
Holt, L. E., Jr., SA65, 241
Holzel, A., 39
Homeyer, P. G., 300
Hope, D. B., 178
Hopkins, C. Y., 331
Hopper, J. H., LE32
Hotta, S., 152
Houpt, T. R., 12
House, W. B., 181
Howe, P. E. 77, 342
Howton, D. R., 55
Hsia, D. Y.-Y., 39
Hubbell, R. B., 331
de la Huerga, J., 313
Huffman, C. F., 300
Huffman, S., 81, 83
Hundley, J. M., 46, 244, 305
Hungate, R. E., 300
Hunt, A. D., Jr., 10, SA161
Hutchin, M. E., 48
Hutchinson, H. D., 15
Hyde, G. M., 14
Hyde, P. M., 185

Iampietro, P. F., 237
Iber, F. L., 37, 73
Ikkos, D., 253
Indravati, D., 44

Ing, B. B., 305
Ingle, D. J., 167
Ingraham, L., 21
Insull, W., Jr., 81, 89
Ivy, A. C., 168, 186
Ivy, E. K., 168

Jackson, H. C., 342
Jackson, R. G., 164
Jacobson, N. L., 300
Janowitz H. S., 60
Jarnum, S. A., 12
Jayko, M. E., 131
Jeans, P. C., 326
Jeffrey, S. W., 281
Jelliffe, D. B., 238
Jensen, L. S., 108
Jensen, R., 15, 299
Jensen, W. N., 178
Johns, A. T., 300
Johnson, B. C., 17, LE32, 80, 252
Johnson, D., Jr., 242
Johnson, E. L., 344
Johnson, R. E., 77, 237
Johnson, R. H., 300
Johnson, R. M., 86
Johnston, J. A., 326
Jolliffe, N., 271, 292
Jones, H. B., 81, 263
Jones, R. J., 81, 83
Julian, L. M., 14

Kagan, A., SA1
Kannel, W. B., SA1
Kaplan, J., 240
Kark, R. M., 26, 71, 77, 237
Karnofsky, D. A., 248
Karvinen, E., 168
Kasperkaja, Z. A., 287
Katz, L. N., 42
Katzin, B., 185
Kaufman, B., 115
Kaufmann, E., 183
Keating, E. R., 179
Kehoe, R. A., 23
Keller, E. B., 252
Kellner, H., 277
Kendall, F. E., 42
Kent, H. N., SA321
Kern, F., Jr., 164
Keys, A., 25, 42, SA65, 77, SA129, 228
Kieckebusch, W., 313
Kihara, H., 190
Killam, K. F., SA161
Killander, A., 235
Kim, K. S., 168, 186
Kimball, C. P., 60
King, J. S., 281
Kinsell, L. W., 81, 82, 89
Kleeman, C. R., 269
Kleiber, M., 141, 172, 300
Kleiger, S. C., 44
Klein, H. P., 305
Klein, R., 247
Kline, D. L., 183, 186
Knott, E. M., 44
Knox, W. E., 39
Kocegina, V. V., 287
Koch, A. L., 304
Koeppe, O. J., 313
Kolmer, J. A., 25
Komrower, G. M., 39
Kon, S. K., 44, 115
Kondi, A., 330
Konishi, F., 77
Krane, S. M., 269
Kratzer, F. H., 50, 344
Krehl,W. A., 140, 305, 313, 350
Kriss, J. P., 296
Kristensen, G., 25, 89
Kritchevsky, D., 81
Kritzer, M. D., 296
Kruse, I., 113
Kuffler, S. W., SA161
Kulp, J. L., 153
Kuttner, A., 342
Kuwabara, T., 121

Lamb, A. R., 117
Lang, J. M., 154
Lang, K., 313
Langham, W. H., 153
Laron, A., 247
Lasarow, A., 183
Lasichak, A. G., 7
Lathem, W., 39
Latner, A. L., 307
Lawrence, J. H., 14
Lawry, E. Y., 83
Lazarus, S. S., 60
Legg, M. A., 140
Lembeck, F., 347
Lengemann, F. W., 315
Lentini, E. A., 140
Leone, N. C., 117, 277
Lepkovsky, S., 53, 246, 334
Levenson, S. M., 73, 164
Levey, S., 7
Levi, M., SA257
Levin, E., 86
Levine, R. S., 164
Levinton, L., 157
Levitin, H., 269
Levy, H. R., 304
Levy, L., N127
Levy, M., 95, 125, SA321
Lew, W., 183
Lewis, B., 131, 186
Lewis, E. B., 153
Lewis, G., 78
Li, C. H., 253
Libbey, R. L., 71
Libby, R. L., 307
Libby, W. F., 153
Lichstein, H. C., 116
Liener, I. E., 242, 344
Liepa, E., 60
Likins, R. C., 340
Lillie, R. D., 149
Lin, T. M., 168
Lindahl, I. L., 300
Lindsay, S., 25
Lipman, F., 305
Little, R. B., 342
Ljungdahl, L., 147
Loesch, H. H., 145
Long, C. N. H., 185
Long, N. W., Jr., 296
Lotz, W. E., 277
Lous, P., 235
Love, R. A., SA1
Lowe, C. U., 323
Lucas, J. M., 172
Luckhardt, A. B., 7
Luft, R., 253
Luick, J. R., 141, 172
Lukens, F. D. W., 152, 177
Lundin, H., 147
Lyman, C. M., 344

McCance, R. A., 144
McCann, M. B., SA65
McCann, S. M., 302
McCay, C. M., 117
McClure, F. J., 117
McCrory, W. W., 10
McDonald, M. W., 241
McDonald, R. A., 347
McDougall, A. I., 281
McGanity, W. J., 6, SA161
McGill, R. F., 173
McGinnis, J., 108
McIlwain, H., SA257
McKibben, J. M., 164
McKinley, J. B., 326
McLean, F. C., 92
McMullen, J., 281
McNaught, M. L., 115
MacDougall, A. J., 167
MacKay, E. M., 337

MacKay, L. L., 337
Mackenzie, C. G., 82
Maclay, W. D., 300
Macy, I. G., 44
Magill, G. B., 248
Maher, T. H., 153
Mainland, D., 101
Mallory, G. K., 347
Manchester, K. L., 281
Mangan, J. L., 300
Manganelli, G., 89
Mann, G. V., SA1, SA129
Marston, H. R., 78
Martin, M. P., 6
Martin, T. E., 164
Mason, K. E., 25
Mathues, J. K., 113
Matsui, K., 336
Maurer, R. L., 117
Mauron, J., 344
Mawson, E. H., 44
Mayer, G. A., 68
Mayer, J., 7, 58, 279, 302
Mead, J. F., 55, 89, 284, 348
Meade, B. W., 167, 281
Meadors, G. F., SA1
Medes, G., 152
Mehta, R., 252
Melin, M., 263
Melinkoff, S. M., 7
Mellanby, E., 87
Mellander, O., 334
Melnick, D., 59
Mendel, L. B., 56, 242, 331
Menschick, W., 89
Merrills, R. J., 307
Metcoff, J., 99
Metta, V. C., 80
Meulengracht, E., 235
Meyer, C. E., 164
Meyer, H. F., 233, N351
Michel, R., 52
Miester, A., 323
Milch, R. A., 244
Miller, H. C., 296
Miller, L. L., 137
Miller, M., 70
Miller, M. C., 25
Mills, C. F., 78
Milstrey, R., 149
Mirsky, I. A., 137
Mitchell, H. H., 56, 80, 188, 329
Moe, J. G., 149
Moehlig, R. C., 247
Mollin, D. L., 235
Molony, C. J., 10, 231
Mondoni, B., 82
Mone, P. E., 51
Montag, W., 284
Moore, C. V., SA65, 113, 170
Moore, F. E., SA1
Moore, H., SA97
Moore, L. A., 181
Morehouse, M. G., 331
Morell, A. G., 37
Morgan, A. F., 44, 316, 331
Morgan, J. F., SA321
Morgan, T. B., 126
Morris, E. R., 181
Morris, J. N., SA129
Morris, M. D., 110
Morrison, S. D., 302
Morton, R. A., 16
Mosbach, E. H., 25
Moscosco, I., 267
Mosher, R. E., 89
Mottu, F., 344
Moudgal, N. R., 19
Moxon, A. L., 174
Mueller, J. F., 164
Mueller, R., 179
Muhrer, M. E., 115
Mumford, C. W., 242
Munro, M. I., 344
Murakami, F., 336
Murlin, J. R., 60
Murphy, E. A., 245
Murphy, M. L., 248
Murray, T. K., 331
Mussehl, F. E., 242
Myant, N. B., 52, 179
Myasnikov, A. L., 274
Myers, W. P. L., 248

Nakayama, Y., 273
Nanjo, H., 336
Nasset, E. S., SA65, 334
Nataf, B., 52
Necheles, H., 95
Nelson, E. M., 331
Nelson, K. R., 145
Nelson, T. S., 113
Nelson, W. O., 115
Neuberger, A., 29
Neumann, H. H., 191
Newcombe, H. B., 153
Newman, K. J., 326
Nichols, C. W., 25
Nicholson, W. M., 179
Nicolaysen, R., 148
Nielsen, K., 89
Nielsen, N., 147
Niemąn, C., 116
Nieweg, H. O., 307
Noble, R. L., 81, 245
Nordbring, F., 261
Norman, F. A., 253
Norris, L. C., 113
Norton, P. M., 5
Nugent, B. O., 296
Nunn, L. C. A., 59, 284

O'Connor, F. J., 140
O'Dell, B. L., 181
Okey, R., 25
Olivecrona, H., 253
Olson, R. E., SA65, SA97
Oncley, J. L., 263
Orabona, M. L., 89
Orto, L. A., 132
Osborne, T. B., 56, 242
Oser, B. L., 113
Oser, M., 113
Osher, S., 137
Overton, D. E., 117
Owen, J. A., 296
Owin, E. C., 44
Oyama, V. I., 95, 125, SA321

Page, I. H., 89
Pallansch, M. J., 242
Pandit, C. G., 277
Papkoff, H., 253
Parfentjev, I. A., 337
Park, E. A., 247
Parmelee, A. H., 10, 231
Paschkis, K. E., 177
Pasher, I., 230
Passmore, R., 228
Patterson, E. L., 149
Payne, I. R., 331
Perlzweig, W. A., 337
Peryam, D. R., SA257
Peterson, M. S., SA257
Peterson, R. E., 85
Peterson, W. E., 261
Pfander, W. H., 15, 115
Pfleiderer, E., 274
Philips, F. S., 248
Phillips, P. H., 117, 181, 331, 342
Philpot, G. R., 247
Pickett, E. E., 181
Pierce, A. W., 117
Piez, A., SA321
Piez, K. A., 157, 340
Pilgrim, F. J., SA257
Pinsent, J., 174
Plećaš, T., SA257
Plumb, E., 137
Plzak, J. E., 164

Poling, C. E., 51
Poo, L. J., 183
Popper, H. L., 95
Portman, O. W., SA65, 83
Poth, E. J., 60
Prange, I., 25, 89, 113
Pratt, E. L., 5, SA65, 253
Pratt, J. P., 44
Prickett, C. O., 89
Proctor, B. E., 80
Prout, T. E., 283
Pruss, M. P., 231
Pruzansky, J., 305
Puck, T. T., SA321
Pyle, S. I., 101

Quattlebaum J. K. Jr., 307
Quin, J. I., 300

Rabinowitz, J. C., 231
Rachmilewitz, M., 230
Radovanović, M., SA257
Rall, D. P., 244
Ramanathan, K. S., SA129
Rama-Sastri, B. V., 44
Ramseyer, W. F., 117
Randle, P. J., 281
Ratner, B., 342
Ratner, S., 29
Raulin, J., 186
Read, G., 87
Read, W. O., 60
Redfield, B. G., 85
Reed, R. B., 326
Regan, W. O., 181
Reid, C. S. W., 300
Reid, J., 167, 281
Reifenstein, E. C., 247
Reiffel, L., 71
Reis, B. B., 60
Reiser, R., 55
Reiss, O. K., 81, 83
Rhian, M., 174
Rice, E. E., 51
Richards, J. F., 331
Richert, D. A., 23, 142
Rieckehoff, I. G., 89, 284
Ritchie, F. J., 228
Rittenberg, D., 29
Robbins, S. L., 347
Roberts, E., SA161
Roberts, T. N., 102, 135
Robinson, J. G., 90
Robson, E. B., 39
Roche, J., 52
Rodman, G. P., 149
Rodney, G., 50
Rogers, T. A., 172
Roine, P., 181
Rolfe, E. J., 344
Rollman, H. S., 331
Ropes, M., 269
Rose, A. S., 71
Rose, E., 269
Rosen, H., 73
Rosenberg, H. R., 15
Rosenblum, C., 307
Rosenfeld, B., 154
Rosenthal, H. L., 285
Ross, G. I. M., 235
Rumsfeld, H. W., Jr., 337
Ruskin, H., 298
Russell, R. S., 153
Rust, J. H., 277
Ryabinina, Z. A., 304

Saidel, L., SA161
Salmon, W. D., 89
Sampson, A. G., 46
Sandegren, E., 147
Sandler, M., 294
Sandstead, H. R., 46
Sandstedt, R. M., 242
Sanger, F., 344
Sarett, H. P., 231
Sarett, L. H., SA161
Sarma, P. S., 19
Sarwar, M., 261
Sato, G., SA321
Scheinberg, I. H., 37
Schilling, R. F., 325
Schlesinger, E. R., 117
Schloesser, L. L., 325
Schmidt-Nielsen, B., 12
Schmidt-Nielsen, K., 12
Schneider, G., 147
Schoenheimer, R., 29
Schofield, B., 307
Schor, H. C., 77
Schrader, G. A., 89
Schulert, A. R., 153
Schulman, M. P., 23, 142
Schultze, M. O., 313
Schulz, J., 170
Schurr, P. E., 164
Schwartz, I. L., 292
Schwartz, M., 235
Schwartz, V., 39
Schwarz, K., 149, 174
Schweigert, B. S., 344
Schwerin, R., N351
Scott, C. C., 7
Scott, G. W., 283
Scott, H. M., LE32
Scott, H. W., Jr., 317
Scott, M. L., 113, 149, 174
Scott, W. W., 7
Scowen, E. F., 75
Scrimshaw, N. S., SA65
Sebrell, W. H., 149, SA257
Seeley, R. D., 285
Segal, H. L., 137
Sellers, A. L., 337
Sellers, E. A., 188
Sénécal, J., 259
Serebrovsky, A. S., 241
Shawver, C. B., 300
Sheehy, T. W., 164
Shemin, D., 29
Shingleton, W. W., 9
Shipley, R. A., 179
Shohl, A. T., 92
Sholl, L. B., 181
Shortt, H. E., 117
Sidbury, J. B., Jr., 323
Siddiqui, A. H., 117
Siliprandi, N., 312
Silver, B. S., 300
Simikov, P. V., 287
Siminovich, L., 304
Simmonds, S., 179
Simpson, I. A., 44
Sinclair, H. M., 59, 81, 144
Sinex, F. M., 281
Siperstein, M. D., 131
Skinner, B. F., 58
Slaton, W. H., Jr., 55, 89, 284
Smedley-MacLean, I. 59, 284
Smith, C. A. H., 117
Smith, E. L., 342
Smith, G. H., 281
Smith, J. A. B., 115
Smith, M. J. H., 167, 281
Smith, N. J., 170, 234
Smith, T., 342
Smith, V. R., 342
Smyth, C. J., 7
Snell, E. E. 116, 190, 231
Snow, P. J. D., 294
Sobotka, H., 230
Søndergaard, E., 89, 113
Sorokin, P. A., SA257
Spicer, G. S., 315
Spivey, H. E., 112, 334
Sprince, H., 190
Srikantia, S. G., 288
Srinivasan, V., 19
Stahlman, M., 317
Stamler, J., 42

Stanbury, J. B., 269
Stare, F. J., SA65
Stearns, G., 68, 326
Steenbock, H., 242, 331
Steffee, C. H., Jr., 155
Steinbach, A. L., 247
Steinberg, G., 55
Steiner, A., 42
Steinkamp, R., 113
Stellar, E., 302
Sternberg, S. S., 248
Stez, M., 52
Stokes, J., SA1, 10
Stokstad, E. L. R., 149
Stolzenbach, F. E., 310
Stone, C. A., 71
Strong, J. A., 228
Stroud, H. H., 10
Stuart, H. C., 326
Stunkard, A. J., 60
Stutman, L. J., 164
Suckling, P. V., 36
Sure, B., 56
Sutherland, E. W., 60
Swain, H. L., 77
Swenseid, M. E., 307

Teitelbaum, P., 302
Terres-Bracamonte, F., 44
Thaysen, T. E. H., 234
Therien, M., 188
Thomas, W. A., SA65
Thomasson, H. J., 81, 350
Thorn, D. W., 145
Thorn, G. W., 145
Titus, E., 83
Todd, T. W., 101
Tomhave, A. E., 242
Toporek, M., 307
Tower, D. B., SA161
Trasarti, F., 82
Traub, A., 116
Treadwell, C. R., 188
Trelease, S. F., 174
Tribble, L. F., 15
Trum, B. F., 14
Tsaltas, T. T., 80, 82, 89
Tsien, W. S., 344
Tsuno, S., 336
Tucker, R. G., 113
Tufts, E. V., 181
Turano, C., 312
Turk, A., SA257
Tuttle, S., 269

Udenfriend, S., 85
Upjohn, H. L., 164
Urist, M. R., 92
Uzman, L. L., 37

Vahouny, G. V., 188
Valadian, I., 326
Vallee, B. L., SA65
Vallentyne, J. R., N127
Vandepopuliere, J. M., 181
Vander, J. B., SA1
Van Itallie, T. B., 59, 60, SA65, SA129
van Reen, R., 310
Visek, W. J., 277
Vitale, J. J., 279
Vohra, P., 50

Wachstein, M., 231
Wagle, S. R., 17, 252
Wakeman, A. J., 331
Walker, A. R. P., 25, LE31, 267
Wall, R., 299
Wallis, L. A., 39
Warner, W. D., 51
Wasserman, R. H., 153, 315
Watanabe, H., 336
Watkin, D. M., 164
Watson, C. J., 25
Watson, G. M., 307
Watts, R. W. E., 75
Weaver, J. A., 283
Weaver, J. M., 242
Webster, H. D., 164
Weinhouse, S., 152
Weiss, K. E., 300
Weissbach, H., 85
Welbourn, H. F., 238
Welch, A. D., 305
Welch, B. E., 237
Wellin, E., SA257
Werner, S. C., 52
Wertheimer, E., 183
West, W. S., 312
Westphal, U., 145
Westwater, J. O., 266
Whedon, A. D., 140, 350
Whedon, G. D., 46
Wheldon, A. D., 305
White, P. L., SA65
Whitney, I. B., 315
Wicks, L. F., 337
Widdowson, E. M., 144
Widmer, C., Jr., 89, 284
Wilber, P. B., 39
Wilkinson, C. F., 164
Williams, J. D., 71
Williams, L. W., 116, 300
Williams, V. R., 116
Winternitz, W. W., 185
Wissler, R. W., 155
Wolbach, S. B., 92
Wolf, A., 240
Wolf, G., 17
Wolf, I. J., 240
Wolf, L. E., 106
Wollridge, R. L., 155
Woodbury, D. M., SA161
Woodward, H., Jr., 70
Woolley, D. W., 112, 180, 267
Wright, L. D., 305

Yagi, T., 273
Yoshimura, M., 336
You, S. S., 188
Yudkin, J., 126

Zamecnik, P., 252
Žarković, G., SA257
Zavattaro, D. N., 132
Zimmerman, H., 313
Ziro, S., 336
Zollinger, R. M., 60

SUBJECT INDEX

The letters SA preceding the page number designate a special signed article; N refers to articles in the Notes Section.

Abortion
incidence, relation to ascorbic acid nutriture, 6
Absorption
allithiamine, 336
aluminum, 23
antibodies, from colostrum, 261
calcium
effect of cortisone on, 247
effect of vitamin D on, 148
cholesterol
effect of feeding cholesterol on, N31
effect of wool-fat sterols on, 331
in man, 168
colostral proteins, 342
copper
possible role of ceruloplasmin in, 37
copper complexes, in pasture feeds, 78
defects, in idiopathic steatorrhea, 234
ergosterol, species differences in, 16
fat
effect of constituent fatty acids on, 331
following gastrectomy, 9
folacin, in sprue, 166
iron
effect of dietary ascorbic acid plus vitamin E on, 113
effect of diet on, SA353
in children, 170
minerals, in guinea pigs, 181
nitrogen, in children, 326
phospholipid, effect of cholesterol-fatty acid feeding on, 186
strontium, 315
vitamin B_{12}, effect of intrinsic factor on, 235, 307
Acetate
fatty acid synthesis from, effect of growth hormone on, 152
metabolism, in vitamin A deficiency, 17
utilization, by sheep, 207
Acetoacetate
in urine, effect of oxalacetate and citrate on, 312
Acetone
in urine
during growth hormone administration, 253
in a thiamine deficient infant, 240
Acidity
achlorhydria, uropepsin levels in, 137
Acidosis
diabetic
blood level of unesterified fatty acids in, 135
use of glucose versus fructose in treatment, 70
ACTH (*see* **Hormones**)
Adipose Tissue
carotenoid storage in, N192
cholesterol in, effect of feeding peanut oil on, 89
composition, effect of dietary fat on, 284
lipogranulomas in, from dietary acetylated fats, 317
source of plasma unesterified fatty acids, 102
water content, relation to appetite, 53
Adrenal
adrenogenital syndrome, genetic defect, 323
carotenoid stores, in, N192
role in control of water consumption, 302
weight, in cats given fluorohydrocortisone, 177
Africa
anemia in, origins of, 330
artificial feeding of infants in, 238
infants, kwashiorkor in, 36
nutrition in, Third Inter-African Conference on, N63
Age
groups, in Australia, incidence of heart disease in, SA129
relation to amino acid excretion, 5
relation to incidence of heart disease, SA1
relation to lipoprotein patterns, 263
relation to production of essential fatty acid deficiency, SA33
skeletal, evaluation by X-rays, 101
Aging
research on, SA225
Alanine (*see* **Amino Acids**)
Albumin
formation from glucose or fructose, in the dairy cow, 172
Alfalfa
dehydrated, in animal feeds, bloat from, 300
Algae
protein, biologic value, 22
Allithiamine
biologic activity of, 336
Altitude
relation to blood cholesterol levels, 331
relation to myoglobin and iron enzyme levels, SA353
Aluminum (*see* **Trace Elements**)
American Medical Association
Council on Food and Nutrition, program of, SA65
Amines
growth factors for bacteria, 190
γ-Aminobutyric Acid
metabolism, in brain, SA161
Aminolevulinic Acid
heme synthesis from, in pantothenic acid and pyridoxine deficiencies, 23
synthesis, in pyridoxine and pantothenic acid deficiency, 142
Amino Acids
alanine
incorporation into protein, in vitamin B_{12} deficiency, 252
synthesis from acetate, in vitamin A deficiency, 17
aspartic acid, synthesis from acetate, in vitamin A deficiency, 17
blood levels, relation to appetite, 7
blood pattern, in hereditary glyceinuria, 48
cystathionine, metabolism, role of pyridoxine in, 178
cysteine
in liver of chicks, after methionine administration, 241
metabolism, thiazolidine carboxylic acid as product of, 82
deficiencies, on low protein diets for weight reduction, 292
destruction by irradiation, 80
excretion pattern, 548
glutamate
incorporation into muscle protein, effect of aspirin on, 281
plasma levels, in hepatic coma, 73
role in brain metabolism, SA161

Amino Acids—(*Continued*)
glutamine, direct utilization by HeLa cells, in tissue culture, 157, SA321
glycine
heme synthesis from, in pantothenic acid and pyridoxine deficiencies, 23
in skin, in ascorbic acid deficiency, 218
in urine, in hereditary glycinuria, 48
incorporation into hemin, in pyridoxine and pantothenic acid deficiency, 142
incorporation into muscle protein, effect of aspirin on, 281
metabolism, in tissues, 29
source of oxalate, in primary hyperoxaluria, 75
histidine
biosynthesis, role of folacin in, N127
dietary, effect on blood cholesterol level, 213
homocysteine, metabolism, role of pyridoxine in, 178
homoserine, metabolism, role of pyridoxine in, 178
hydroxyproline, formation from proline, in scurvy, 218
in urine
in disease, 39
in infants, 5
in kwashiorkor, 259
in primary hyperoxaluria, 75
in Wilson's disease, 37
intake, relation to arterio-venous blood glucose difference, 7
lysine
deficiency, metabolic effects of, N287
dietary supplementation for the aged, 132
hydroxylation, in collagen synthesis, 340
in yeast, availability, 344
incorporation into muscle protein, effect of aspirin on, 281
requirement
for feather pigmentation in turkeys, 50
for longevity, 313
for pigs, 15
metabolism, in protein deficiency, 216
methionine
deficiency, metabolic effects of, N287
dietary
effect on biologic value of bacterial proteins, 115
effect on copper excretion, 37
effect on dermatitis from urinary ammonia, 105
in poultry feeds, breed differences in response to, 241
incorporation into protein, in vitamin B_{12} deficiency, 252
metabolism in kidney, production of hypertensive agents, 87
plasma levels, in hepatic coma, 73
reversal of bacterial growth inhibition by aminopterin, N127
mixtures, insufficiency for chick growth, 111
phenylalanine
incorporation into protein, in vitamin B_{12} deficiency, 252
metabolism, metabolic blocks in, 323
plasma levels, in hepatic coma, 73
proline
conversion to hydroxyproline, in scurvy, 218
synthesis from glutamine, by HeLa cells in tissue culture, 157
requirements
for bacteria for growth, 21
for HeLa cells in tissue culture, SA321
for lactation and reproduction, 313
for *P. pestis*, 21
serine
incorporation into protein, effect of vitamin B_{12} on, 252
radioactivity in, after injection of C^{14} glycine, 29
supplementation of rice, effect on nitrogen balance, 46
threonine
imbalance in diet, effect on growth, 313
plasma levels, in hepatic coma, 73
tryptophan
conversion to niacin, in the duck, 310
conversion to serotonin, 85
deficiency, metabolic effects of, N287
dietary, effect on biologic value of bacterial proteins, 115
imbalance in diet, effect on growth, 313
metabolites of, formed by carcinoid tumors, 294
role of pyridoxine in metabolism, 178
uptake by malignant carcinoid, N223
tyrosine
decarboxylation, assay method for pyridoxal phosphate, 231
oxidation by liver, in protein deficiency, 216
plasma levels, in hepatic coma, 73
valine, requirements for longevity, 313
Ammonia
dermatitis from, effect of methionine feeding on, 105
excretion, in the guinea pig, 181
Amphetamine (*see* **Drugs**)
Anemia
hemolytic, phosphatase activity in white cells, 222
in infants with kwashiorkor, 36
iron deficiency, tissue cytochrome-c levels in, 155
pantothenic acid or pyridoxine deficiency, 23
parenteral fat feeding, 164
pernicious
treatment with intrinsic factor, refractory state in, 235
turnover of vitamin B_{12} in, 325
uropepsin levels in, 137
relation to cellular iron metabolism, SA353
serum proteins in, 330
Anesthesia
effect on serum transaminase activity, 204
Anoxia
effect on blood cholesterol level and lipoidosis, in experimental atherosclerosis, 274
Antibiotics (*see* **Drugs,** antibodies)
Antibody
absorption, intestinal, 342
levels in cord versus maternal blood, 261
Antimetabolites
aminopterin, growth inhibitor of microorganisms, N127
antipurines, toxicity of, 248
desoxycarnitine, inhibitor of carnitine synthesis, 214
erucic acid, effect on reproductive functions, 245
tetracycline, tissue fluorescence after administration, 244

toxic effects of, 248
trans-acids, as essential fatty acid antagonists, 59
Antioxidants
diphenyl-p-phenylene diamine, effect on iron utilization, 113
Antipyrine
determination of body water, comparison with urea method, 199
Aorta
cholesterol in, effect of feeding peanut oil on, 89
lesions, in experimental atherosclerosis in rabbits, 211, 274
Appetite
control
by blood glucose and amino acid levels, 7
by hypothalamus, 302
by water content of tissues, 53
in mice, effect on feeding pattern, 58
relation to water loss, in the camel, 12
stimulation of, N287, 7
Arachidoside
goitrogenic, from groundnuts, 19
Arctic
food intake in, 202
Army
caloric intake of soldiers, relation to environmental temperature, 202, 237
nutritional status, in foreign armed forces, SA193
self-selection of foods by soldiers, 77
Arteriosclerosis (*see* **Atherosclerosis**)
Arteriovenous Difference
glucose, relation to appetite, 7
in unesterified fatty acid, 102
Arthritis (*see* **Disease**)
Ascorbic Acid
deficiency, in the Bantu, 267
effect on blood cholesterol level and lipoidosis in experimental atherosclerosis, 274
effect on copper binding in ceruloplasmin, 37
effect on hemoglobin synthesis, 113
effect on pantothenic acid deficiency, role of intestinal bacteria, 305
intake
in pregnancy, relation to serum ascorbic acid levels, 6
of Cuban children, 271
nutrition, in foreign armed forces, SA193
role in collagen formation and wound healing, 218
Aspartic Acid (*see* **Amino Acids**)
Aspirin (*see* **Drugs**)
Assay
body water, evaluation of methods, 199
energy content of foods, new method, 51
fecal fat, 331
lysine, biological versus chemical, 344
protein value, methods for, 56
pyridoxal phosphate, in blood, 231
unesterified fatty acids, in plasma, 102, 135
uropepsin, 137
Atherosclerosis
blood lipid and lipoprotein fractions in, 263
blood pyridoxal phosphate levels in, 231
experimental
effect of corn oil versus cottonseed oil on, 83
in rabbits, 211
relation to type of fatty acid fed, 81, 89
research in Russia, 213, 274
incidence, in the Bantu, 267
relation to cholesterol intake, Minnesota and Sardinia Studies, 42
relation to diet, discussion, SA1
relation to dietary fat, discussion, SA129
relation to essential fatty acid deficiency, SA33
relation to vitamin D feeding, N159
research, role of Public Health Service, SA225
treatment with histidine, 213
Australia
coronary heart disease in, SA129
Availability
copper in pasture feeds, 78
lysine, in yeast, 344

Baboon
diet and the ovarian cycle of, 145
Bacteria
cells, nutritive value of, 115, N224
growth, effect of malate on, 116
intestinal
growth, effect of sorbitol on, 126
role in ascorbic acid effect in pantothenic acid deficiency, 305
L. casei, growth factors for, in protein digests, 190
P. pestis, amino acid requirements for, 21
rumen, relation to production of bloat, 300
utilization of biotin, effect of Tween and unsaturated fatty acids on, 116
Baganda
artificial feeding of infants in, 238
BAL (*see* **Drugs**)
Bantu
incidence of gallstones in, 25
nutritional studies of, 267
Barley
improving the nutritional value of, 108
Basal Metabolic Rate
in diabetes, effect of aspirin on, 167
in essential fatty acid deficiency, 86
Behavior
relation to food habits, SA257
Benzoate
effect on oxalate excretion, 75
Beriberi (*see also* **Thiamine,** deficiency)
in infants, 44, 240
subclinical, in Cuban children, 271
Beryllium
rickets, mast cell counts during, 92
Betaine
metabolism, in kidney, production of hypertensive agents, 87
Bicarbonate
requirements, of HeLa cells, in tissue culture, SA321
Bile
cholesterol level, relation to occurrence of gallstones, 25
feeding, effect on fat absorption following gastrectomy, 9
Bile Acids
fecal excretion, relation to type of dietary fat, 131
Bilirubin
in urine, as glucuronide, in familial non-hemolytic jaundice, 323
Biologic Activity
allithiamine, 336
growth hormone, from human pituitaries, 253

Biologic Value
bacterial cells, N224
essential fatty acids, 55
protein
algae, 22
assessment of, 56
bacterial, 115
irradiated, 80
plant versus animal, 220
relation to digestibility, 334
soybean, raw versus cooked, 242
Biotin
deficiency, in fish, 106
in high versus low extraction flour, 144
utilization, by bacteria, effect of Tween and unsaturated fatty acids on, 116
Blood
cell counts, in pregnancy, relation to ascorbic acid nutriture, 6
ceruloplasmin, copper binding in, effect of ascorbic acid on, 37
clotting time, relation to essential fatty acid deficiency, SA33
factor, for lipogenesis in cornea slices, 121
pressure
changes, from parenteral fat feeding, 164
in experimental atherosclerosis, effect of drugs on, 274
in portal vein, in liver cirrhosis, 298
response to epinephrine, in experimental atherosclerosis, in rabbits, 213
red cell
glucose-6-phosphate dehydrogenase level, in drug induced hemolysis, 323
incorporation of iron, in protein deficiency, 251
volume, species differences in horse, 14
white cell
folacin in, after folacin administration in sprue, 166
phosphatase activity in disease, 222
pyridoxal phosphate in, 231
Bloat
in ruminants, relation to feeds, 300
Body Composition
water
determinations in undernourished individuals with edema, 199
horses, species differences in, 14
Bone
calcium, in dairy cows, relation to diet, 141
cells, human, in tissue culture, inositol requirements for, N95
changes
in children with Fanconi's syndrome, 39
in experimental xanthomatosis in rabbits, 211
due to fluoride toxicity, 277
citrate levels, effect of cortisone on, 247
deposition of strontium in, 315
effect of long term ingestion of fluoride on, 117
fluorescence, after tetracycline administration, 244
marrow
effect of 6-mercaptopurine on, 248
hemosiderosis, in the Bantu, 267
incorporation of iron, in protein deficiency, 251
iron uptake in, effect of erythropoietin on, SA353
phosphatase activity of cells, 222
mast cells, in calcium deficiency, 92
minerals
in experimental rickets in cats, 140
metabolism, effect of thyroid hormone on, 269
relation to vitamin D deficiency, 148
osteoporosis, occurrence of mast cells in, 92
phosphorus in, effect of dietary aluminum on, 23
strontium in, effect of dietary calcium on, 153
X-ray, evaluation of skeletal age, 101
Book Notices
Annual Report of the National Institute of Nutrition (1956). The National Institute of Nutrition Toyamacho, Tokyo, Japan. 32.
Biochemical Preparations. Vol. V. David Shemin, Wiley & Sons. 128
Calcium Metabolism. J. T. Irving. Johannesburg, South Africa. 160
Calorie Requirements. FAO Nutrition Studies. 128
Chemical Anthropology. I. C. Macy & H. J. Kelly. Univ. of Chicago Press. 128
Chemical Composition of South Pacific Foods. F. E. Peters. South Pacific Commission. New Caledonia. 128.
Chemistry of Lipides as Related to Atherosclerosis. I. H. Page. C. C. Thomas. Springfield, Illinois. 224.
Chemistry of Natural Food Flavors: A Symposium. Advisory Board on Quartermaster Research and Development Committee on Foods. 128.
Dietetique Therapeutique. J. Tremolieres, A. Mosse, and L. Dlebes. G. Doin & Cie, 8 place de l'Odeon, Paris. 288.
The Englishman's Food. J. C. Drummond & A. Wilbraham. London. 160.
Fluoridation of Public Water Supplies. R. E. Owen, Wellington, New Zealand. 160.
Food for Fitness. A Daily Food Guide. Leaflet #424. U. S. Dept. of Agriculture. 256.
Food Guide and Quantity Control for Young Children. Community Council of Greater New York. Harper & Bros. 256.
Frontiers in Science: A Survey. Edited by E. Hutchings, Jr. Basic Books, Inc. New York. 288.
General Biochemistry. J. S. Fruton & S. Simmonds. John Wiley & Sons, Inc. 224.
A History of Nutrition. E. V. McCollum. Houghton Mifflin Co. Boston. 96.
Indian Council of Medical Research. Coonoor, South India. Annual Report for 1955–56. 64.
Introduction to Protein Chemistry. S. W. Fox & J. F. Foster. 160.
Malnutrition and Nutrition Activities in Japan. Joint FAO/WHO Nutrition Committee for South and East Asia Fourth Meeting, Sept.–Oct. 1956. 64.
Manual for Nutrition Surveys. Interdepartmental Committee on Nutrition for National Defense. U. S. Government Printing Office. 256.
Methods of Biochemical Analysis. Vol. 5. D. Glick, Editor. Interscience Publishers. 160.
Methods of Biochemical Analysis. Vol. 6. D. Glick, Editor. Interscience Publishers. 224.
La Nutricion en al Paraguay. F. A. Montalto. Impresora Oeste, Buenos Aires. 192.

The Nutritive Value of Cooked Meat. R. M. Leverton and G. V. Odel. National Live Stock and Meat Board. Chicago. 320.
The Physiology and Biochemistry of Lactation. S. J. Folley. C. C. Thomas. 96.
To Plow with Hope. D. K. Faris. Harper & Bros., New York. 320.
Practical Nutrition. A. B. Peyton. J. B. Lippincott Co. 96.
Prevention of Chronic Illness. Vol. I. Commission of Chronic Illness. Harvard Univ. Press, 128.
Procedures for the Testing of Food Additives: Second Report of the Joint FAO/WHO Expert Committee on Food Additives. 288.
Proceedings of the Nutrition Education Conference. U. S. Dept. of Agriculture. 160.
Processed Plant Protein Foodstuffs. A. M. Altschul. Academic Press, Inc. 288.
Protein Requirements. FAO of the United Nations. Rome. 160.
Resource Training for Business, Industry, Government. Published for the Natural Resources Study Committee by the Conservation Foundation, New York. 352.
The Rockefeller Report on Education: The Pursuit of Excellence. Education and the Future of America. Special Studies Report V, Rockefeller Brothers Fund. Doubleday & Co., Inc. 256.
Role of Dietary Fat in Human Health: A report of the Food & Nutrition Board, National Academy of Sciences, National Research Council. 224.
The Rowett Research Institute Collected Papers: Summary and Subject Reviews. Vol. XIII. Reid Library. The Rowett Research Institute. Bucksburn, Aberdeenshire. 32.
Sterilization in Food Technology. C. Olin Ball and F. C. W. Olson. McGraw-Hill Book Co. 32.
A Study of the Dietary Background and Nutriture of the Navajo Indian. A reprint from the *Journal of Nutrition*, Vol. 60, suppl. 2, p. 85, November 1956. 96
Swine Feeding and Nutrition. Vol. I. T. J. Cunha. Interscience Publishers, Inc. New York. 192.
Technical Report of the Scientific Advisory Board for the Year 1956. Indian Council of Medical Research, Delhi. 160
A Textbook of Dairy Chemistry. Third edition, revised. E. R. Ling. Philosophical Library, New York. 192.
Trace Analysis. J. H. Yoe and H. J. Koch, editors. 160.
Water Fluoridation: Facts, Not Myths. L. I. Dublin. Public Affairs Pamphlets. 128.
The World Health Organization: Its Global Battle Against Disease. A. Deutsch. Public Affairs Pamphlets, New York. 256.

Brain
cerebral activity, in pyridoxine deficiency, SA161
cholesterol in, effect of feeding peanut oil on, 89
glutamic acid levels in, effect of convulsant drugs on, SA161
hypothalamus, a factor in regulation of body water, 302
lipids, synthesis from acetate, in vitamin A deficiency, 17
metabolism, role of serotonin in, 85
pathology, in copper deficiency of sheep, 78
Bread
relative nutritive values of high-extraction and enriched flour, 144
Breast-Feeding
incidence
in Africa, 238
in the United States, N351
role in immunity, 261
Bromsulphalein
excretion test, in obesity, 266
Butterfat
dietary, effect on plasma cholesterol level, 68
Butyrate
feeding, ketosis from, effect of oxalacetate and citrate on, 312

Calcification
aortic, in essential fatty acid deficiency in swine, SA33
changes, in fluorosis, 277
effect of cortisone on, 247
in primary hyperoxaluria, 75
in the guinea pig, mineral requirements for, 181
relation to vitamin D deficiency, 148
Calcium
absorption
effect of cortisone on, 247
effect of vitamin D on, 148
balance
effect of growth hormone on, 253
in children, effect of 6-mercaptopurine on, 248
studies in the guinea pig, 181
blood levels
in experimental rickets in cats, 140
in magnesium deficiency in calves, 173
deficiency
in the Bantu, 267
mast cell counts in, 92
dietary
effect on fat absorption, 331
effect on strontium retention, 153
excretory routes, N62
intake
of Cuban children, 271
of infants, 67
metabolism
effect of thyroid hormone on, 269
of dairy cows, 141
needs, contribution of bread to, in World War II, 144
oxalate, renal stones, in hereditary glycinuria, 48
renal clearance, effect of vitamin D on, 205
requirements, discussion, N31
secretion in milk, comparison with strontium, 315
to phosphorus ratio
dietary
relation to calcium metabolism in dairy cows, 141
relation to production of rickets in cats, 140
Calf (*see* **Cattle**)
Caloric Intake
contribution of bread, during World War II, 144
effect on fat absorption following gastrectomy, 9
from parenteral fat emulsions, 164
in the Arctic, 202

Caloric Intake—(*Continued*)
of baboons, relation to menstrual cycle, 145
of infants, 67
of soldiers, by self-selection, 77
reduced, effect on hunger, 228
regulation of nitrogen release from liver by, 183
relation to calories deposited, during growth, 279
relation to environmental temperature, 237
relation to incidence of diabetes, in Japan, 273
relation to nitrogen balance, 196, 285
Camel
water requirements, 12
Cancer
antipurine therapy, toxicity of, 248
carcinoid, serotonin metabolism in, N223, 294
cells, in tissue culture, inositol requirements for, N95
HeLa cells, requirements for tissue culture, 157, SA321
liver, cancerogenic activity of maleic hydrazide, 217
phosphatase activity in white cells, 222
stomach, uropepsin levels in, 137
tissue, fluorescence in, after tetracycline administration, 244
Carbohydrate
dietary
effect on blood level of plasma unesterified fatty acids, 102, 135
effect on in vivo protein digestion, 334
relation to nitrogen release from liver, 183
requirements in the cold, 188
treatment of Kwashiorkor, 259
fructose
conversion to glycogen, effect of hydrocortisone on, 185
in calf semen, relation to food intake, 209
intravenous feeding, effect on nitrogen balance after surgery, 196
metabolism, in dairy cows, 172
versus glucose, in treatment of diabetic acidosis, 70
glucose
arteriovenous difference, effect of amino acid ingestion on, 7
blood levels
after pentose administration, 200
in diabetes, effect of aspirin on, 167
incorporation into protein, effect of vitamin B_{12} on, 252
metabolism, in cats given fluorohydrocortisone, 177
reabsorption in kidney, relation to aminoacidurias, 39
tolerance test
after delivery, 296
in obesity, 266
uptake by muscle,
activity of I^{131}-insulin on, 283
effect of aspirin on, 281
versus fructose, in treatment of diabetic acidosis, 70
glycogen
in liver and muscle, effect of epinephrine on, 185
synthesis from acetate, in vitamin A deficiency, 17
glycosides, goitrogenic, in groundnuts, 19
intake
of Cuban children, 271
self-selection by soldiers, 77
intravenous feeding, effect on nitrogen balance after surgery, 196
lactose, formation from glucose or fructose, in the dairy cow, 172
metabolism, role of vitamin A in, 17
needs, contribution of bread to, in World War II, 144
oxidation, effect of growth hormone on, 152
pentose, metabolism in man, 200
polysaccharide, in bone, in fluorosis, 277
sorbitol utilization, 126
type, as additive to formulas for feeding newborn infants, 233
utilization, by HeLa cells, in tissue culture, SA321
Carbon Dioxide
combining power, in a thiamine deficient infant, 240
growth promoting action for bacteria, 116
Caries (*see* **Teeth**)
Carnitine
physiological roles, 214
Carotene
preservation in fossil sediments, N127
Carotenoid
tissue stores, in man, N192
Cartilage
changes, in fluorosis, 277
Casein
dietary
effect on proteinuria in rats, 337
effect on thyroid uptake of iodine, 179
formation from glucose or fructose, in the dairy cow, 172
Castration
effect on proteinuria in rats, 337
Cat
experimental diabetes in, from administration of fluorohydrocortisone, 177
pyridoxal phosphate blood level in, 231
vitamin D deficiency in, 140
Cattle
bloat in, causes and treatment, 300
calf
absorption of colostral proteins by, 342
magnesium deficiency in, 173
dairy
calcium metabolism in, 141
fructose metabolism in, 172
Cell
permeability
role of essential fatty acids in, 116
use of pentose in determination of, 200
Central Nervous System
regulation of blood cholesterol level by, 274
Cephalin Flocculation Test
in obesity, 266
Cereal Grain
barley, improvement of nutritional value, 108
protein, efficiency ratio, 56
rye, protein, biologic value, 220
sodium content, N159
Ceruloplasmin
copper binding in, effect of ascorbic acid on, 37
Chick
blood cholesterol levels in, effect of corn oil feeding on, 83
embryo, carnitine synthesis in, 214
exudative diathesis in, prevention by yeast or selenium, 174

feed
barley as, methods of increasing nutritional value, 108
yeast, availability of lysine in, 344
feeding, breed differences in response to methionine, 241
growth, effect of gelatin hydrolysates on, 111
pyridoxine deficiency, tissue serotonin levels in, 85
vitamin E nutrition in, relation to selenium and Factor 3, 149
Children
amino acid excretion in, 5
appetite in, stimulation of, N287
blood pyridoxal phosphate levels in, 231
chronic malnutrition in, electrolyte changes in, 99
Cuban, nutritional status of, 271
edema in, presence of ferritin in blood, N288
Fanconi's syndrome in, effect on bone, 39
feeding, in hot weather, N255
fluid intake of, N191
genetic metabolic diseases in, 323
iron absorption in, 170
Kwashiorkor, treatment and prevention, 259
nutrition of, advances in, SA225
protein requirements for, 326
skeletal age, evaluation by X-ray, 101
thiamine and riboflavin excretion in, 198
toxicity of antipurines for, 248
Chloral Hydrate (*see* **Drugs**)
Chloride
balance, effect of growth hormone on, 253
blood level, in a thiamine deficient infant, 240
changes, in chronic infantile malnutrition, 99
in urine, in amino acid deficiencies, N287
loss, in fibrocystic disease, 323
requirements, for children, in hot weather, N255
Cholesterol
absorption
effect of dietary cholesterol on, N31
effect of wool-fat sterols on, 331
in man, 168
blood levels
effect of corn oil feeding on, 83
effect of histidine feeding on, 213
effect of vitamin D on, N159
in experimental atherosclerosis, effect of drugs and vitamins on, 274
in heart disease, SA1
in obesity, 266
in rabbits with experimental xanthomatosis, 211
in the Bantu, 267
mechanism of lowering by seed fats, 131
relation to altitude, 331
relation to cholesterol intake, in man, 42
relation to exercise, SA129
relation to occurrence of gallstones, 25
relation to type of dietary fat, SA33, 68, 81
conversion to 7-dehydrocholesterol, in guinea pig intestine, 16
esters, in plasma, for transport of fatty acids, 348
feeding, to rabbits, to produce xanthomatosis, 211
fractions, in atherosclerosis, 263
in feces, effect of ascorbic acid on, in experimental atherosclerosis, 274
in liver, after feeding cholesterol-fatty acid mixtures, 186
origin from diet versus synthesis, 110
protein-bound, in urine of mice, 337
synthesis
effect of dietary cholesterol on, 110
effect of fatty acid feeding on, 81
from acetate, in vitamin A deficiency, 17
in liver, effect of growth hormone on, 152
tissue levels, in chicks fed peanut oil, 89
Choline
deficiency
in fish, 106
renal effects of serotonin in, 347
dietary
effect on blood phospholipid levels, 154
effect on toxicity of cholesterol-fatty acid mixtures, 186
Cirrhosis (*see* **Liver,** cirrhosis)
Citrate
blood levels, in experimental rickets in cats, 140
bone and blood levels, effect of cortisone on, 247
effect on ketosis, 312
formation from glucose or fructose, in the dairy cow, 172
in calf semen, relation to food intake, 209
metabolism, in protein deficiency, 216
Climate
cold, relation to caloric intake, 202, 237
hot, feeding infants and children, N255
stresses of, in relation to nutritive needs, 188
Cobalt (*see* **Trace Elements**)
Coconut
oil, dietary, effect on sterol and bile acid excretion, 131
Coenzymes
DPN, in liver, after feeding pyridine derivatives, 310
pyridoxal phosphate
blood levels, 231
role in heme synthesis, 23, 142
role in serotonin formation, 85
Cold
climate, caloric requirements in, 188, 202, 237
Collagen
synthesis
in ascorbic acid deficiency, 218
lysine hydroxylation in, 340
Colostrum
antibodies in, 261
proteins, intestinal absorption of, 342
Convulsions
from drugs, relation to glutamate metabolism, SA161
in calves, in magnesium deficiency, 173
in infants, in pyridoxine deficiency, 10
Copper (*see* **Trace Elements**)
Corn
oil, dietary, effect on plasma cholesterol level, 68, 83
protein, efficiency ratio, 56
Cortisone (*see* **Hormones**)
Cottonseed
meal, lysine in, availability of, 344
Council on Food and Nutrition
program of the American Medical Association, SA65
Creatine
in urine
during growth hormone administration, 253
of infants, 5
Creatinine
in urine, measure of skeletal musculature, 326
Cuba
children

Cuba—(*Continued*)
blood pyridoxal phosphate levels in, 231
nutritional status of, 271
Cyanide
effect on lipogenesis in corneal slices, 121
Cystathionine (*see* **Amino Acids**)
Cysteine (*see* **Amino Acids**)
Cytochrome C
levels in iron deficiency without anemia, 155

Death Rate
from coronary heart disease, in Australia, SA129
7-Dehydrocholesterol
formation, from cholesterol, in guinea pig intestine, 16
Dermatitis
from urinary ammonia, effect of feeding methionine, 105
Detoxication
bilirubin, conjugation with glucuronic acid, in familial non-hemolytic jaundice, 323
Dextran
prevention of pancreatic fat necrosis by, N95
Diabetes
acidosis
effect of oxalacetate and citrate on, 312
use of glucose versus fructose in treatment, 70
alloxan, effect on production of essential fatty acid deficiency, SA33
effect of aspirin administration on, 167
effect of growth hormone administration on, 253
experimental, in cats, from administration of fluorohydrocortisone, 177
in women, association with delivery of large baby, 296
incidence, during food shortage in Japan, 273
unesterified fatty acid metabolism in, 102, 135
Diarrhea
in Baganda infants, artificial versus breast feeding, 238
in chronic infantile malnutrition, 99
Diet
African, discussion, N63
aluminum in, 23
Australia, relation to incidence of heart disease, SA129
Bantu, 267
bread in, contribution to dietary needs, 144
calcium, relation to strontium retention, 153
cholesterol, relation to serum cholesterol levels, in man, 42
climatic influences on nutritive needs, 188
control, necessity in identification of growth factors, N31
Cuban, for children, 271
effect on portal vein pressure, in liver cirrhosis, 298
effect on thyroid function, 179
liquid formula, for weight reduction, 292
lithogenic, 25
lysine-tryptophan ratio in, 132
milk formulas, for the newborn, 233
patterns, of infants, 67
protein, effect on protein efficiency ratio, 56
relation to iron absorption and siderosis, SA353
relation to ovarian cycle of baboon, 145
requirements, in the Arctic, 202
selection, food faddism, discussion, SA97
self-selected, by soldiers, 77
supplementation of the aged, with lysine, 132
therapy, of idiopathic steatorrhea, 234
versus synthesis, in contribution to serum cholesterol, 110
Digestibility
algae protein, 22
barley, methods, for increasing, 108
fats, 331
protein, effect of fatty acid on, N351
Digestion
fat, following gastrectomy, 9
protein, in vivo, 334
Digitalis (*see* **Drugs**)
Dihydrocholesterol
dietary, to produce gallstones in rabbits, 25
Dinitrophenol (*see* **Drugs**)
Diphenyl-p-Phenylene Diamine (**DPPD**)
effect on iron utilization, 113
Disease
acute synovitis, sulfur content of synovial fluid in, 295
adrenogenital syndrome, genetic defect in, synthesis of hydrocortisone, 323
arthritis
research in, discussion, SA225
sulfur content of synovial fluid in, 295
atherosclerosis (*see* Atherosclerosis)
cancer (*see* Cancer)
chronic, control by good nutrition, SA225
cystinosis, amino acid excretion in, 39
cystinuria, excretion of amino acids in, 39
diabetes (*see* Diabetes)
familial non-hemolytic jaundice, bilirubin excretion in, 323
Fanconi's syndrome, excretion changes in, 39
fibrocystic, genetic origin, 323
galactosemia, aminoaciduria in, 39
genetic
in children, 323
research in, discussion, SA225
glycogen storage, aminoaciduria in, 39
goitrous cretinism, a genetic metabolic disease, 323
heart (*see* Heart)
hereditary aminoacidurias in, 39
hereditary glycinuria, 48
Hodgkin's, phosphatase activity in white cells, 222
hypertension (*see* Hypertension)
idiopathic steatorrhea, treatment by exclusion of dietary wheat gluten, 234
infection (*see* Infection)
kidney (*see* Kidney)
Leukemia, phosphatase activity in cells, 222
liver (*see* Liver)
measles, incidence in breast-fed infants, 261
muscle dystrophy (*see* Muscle)
osteomalacia (*see* Bone)
osteoporosis (*see* Bone)
pancreatitis, use of dextran in management, N95
phenylketonuria
diet therapy for, SA257, 323
excretion of amino acids in, 39
polycythemia vera, phosphatase activity in white cells, 222
primary hyperoxaluria, kidney stones in, 75
rheumatic fever, relation to protein intake, 326
sprue, folacin metabolism in, 166
tuberculosis
in children, relation to protein intake, 326
phosphatase activity in white cells, 222
ulcerative colitis, myocardial lesions in, 90
Wernicke's syndrome, in infants, 240

Wilson's
aminoaciduria in, 39
pathology, 37
Dog
pyridoxal phosphate blood level in, 231
DON (*see* **Drugs**)
Donkey
water requirement, 12
DPN (*see* **Coenzymes**)
Drugs
amphetamine, effect on blood cholesterol level and lipoidosis, in experimental atherosclerosis, 274
antibiotics
effect on bloat in steers, 300
effect on growth depression from raw soybean diet, 242
effect on pantothenic acid deficiency, 305
use in treatment of Kwashiorkor, 259
aspirin
effect in diabetes, 167
effect on glucose uptake of muscle, 281
effect on sulfate content of synovial fluid, 295
BAL, effect on copper excretion, 37
chloral hydrate, effect on blood cholesterol level and lipoidosis, in experimental atherosclerosis, 274
6-diazo-5-oxo-2-norleucine (DON), toxicity for intestinal mucosa, 248
digitalis, effect on potassium content of heart, 90
dinitrophenol, effect on lipogenesis in cornea slices, 121
heparin, effect on blood cholesterol level and lipoidosis, in experimental atherosclerosis, 274
megimide, effect on brain glutamic acid levels, SA161
N-methyl-formamide, hepatoxic effects, 248
metrazole, convulsions from prevention by γ-aminobutyrate, SA161
penicillin, treatment of megaloblastic anemia in Africa, 330
permaquine, induction of hemolysis by, 323
phenobarbital, effect on blood cholesterol level and lipoidosis, in experimental atherosclerosis, 274
purine antagonists, toxicity of, 248
strychnine, effect on brain glutamic acid levels, SA161
tetracycline, tissue fluorescence after administration, 244
tolbutamide, effect on plasma level of unesterified fatty acids, 102
Duck
niacin deficiency in, effect of pyridine derivatives on, 310
porphyrin synthesis in, in pyridoxine and pantothenic acid deficiency, 142

Edema
determination of body water in, evaluation of methods, 199
in children, presence of ferritin in blood in, N288
Education
nutrition
program of American Medical Association, SA65
use in combatting food faddism, SA97
status, of men, relation to incidence of heart disease, SA1
Egg
consumption, effect on iron absorption in children, 170
introduction into infants' diets, 67
irradiation, effect on protein quality, 80
protein, efficiency ratio, 56
white
digestion by trypsin, effect of fatty acid on, N351
in animal feeds, relation to production of bloat, 300
Electrocardiogram
changes, in potassium deficiency, 90
Electroencephalogram
changes, in pyridoxine deficiency, 10, SA161
Electrolyte
balance, after surgery, 196
changes
in chronic malnutrition, 99
in idiopathic steatorrhea, 234
levels, in dystrophic muscles, 71
metabolism, effect of parenteral fat feeding on, 164
Electron Microscopy
of liver mitochondria, from essential fatty acid deficient rats, 86
Electrophoresis
of insulin, changes after introducing I^{131}, 283
of proteins in urine of rats, 337
patterns of lipoproteins, in atherosclerosis, 263
Embryo
chick, effect of desoxycarnitine on development, 214
damage, from azaserine, 248
Emotion
in food preferences, SA97
stress in, relation to coronary heart disease, in Australia, SA129
Energy
content of food, new method for measurement, 51
expenditure
exercise programs for, 228
relation to environmental temperature, 237
needs of sheep, lower fatty acids for, 207
Environment
cold, effect on caloric intake, 202, 237
hot, feeding infants and children, N255
relation to nutritive needs, 188
Enzymes
alliinase, in garlic, for conversion of allithiamine to thiamine, 336
amylase, in urine, in amino acid deficiencies, N287
cathepsin, activity in gastric juice in disease, 137
cholesterol dehydrogenase, occurrence and role, 16
clarase, treatment of barley, to increase nutritional value, 108
formic dehydrogenase, formation in *E. coli*, selenium need for, 174
glucose-6-phosphate dehydrogenase, level in red cells, in drug induced hemolysis, 323
5-hydroxytryptophan decarboxylase, function in serotonin formation, 85
iron-containing, in anemia, SA353
pepsin
activity in gastric juice in disease, 137
effect of aluminum on, 23
pepsinogen, blood level, effect of glucagon on, 60

Enzymes—(*Continued*)
phosphatase
blood level
effect of 6-mercaptopurine on, 248
in experimental rickets in cats, 140
in hyperthyroidism, 269
in kidney, effect of long term ingestion of fluoride on, 117
in white cells, in disease, 222
takadiastase, treatment of barley, to increase nutritional value, 108
transaminase
blood level
following surgery, 204
relation to pyridoxine intake, 231
liver activity, in protein deficiency, 216
trypsin, digestion of protein, effect of fatty acid on, N351
uropepsin, assay, 137
Epilepsy
seizures, in pyridoxine deficiency, SA161
Epinephrine (*see* **Hormones**)
Erucic Acid
effect on fertility, 245
Estrogens (*see* **Hormones**)
Ethanolamine Phosphate
in urine, in pyridoxine deficiency, 178
Exercise
effect on blood cholesterol level and lipoidosis, in experimental atherosclerosis, 274
program for weight reduction, 228
relation to coronary heart disease, in Australia, SA129
Exudative Diathesis
prevention by yeast or selenium, 149, 174
Eye
changes, from serotonin, in choline deficiency, 347
cornea, slices, lipogenesis in, 121

Factor 3
activity of yeast, dependence on growth medium, N319
relations with selenium and vitamin E, 149
Faddism
food
discussion, SA97
statement concerning, by the Food and Drug Administration, N191
Fanconi's Syndrome
excessive excretion of amino acids in, 39
Fasting
effect of epinephrine on carbohydrate metabolism in, 185
effect on blood phospholipid levels, 154
nitrogen release from liver in, 183
Fat
acetylated, lipogranulomas from, 317
blood fractions, in atherosclerosis, 263
blood level
following gastrectomy, 9
in the Bantu, 267
body, of horses, species differences in, 14
deposition, in heart and liver, in a thiamine deficient infant, 240
dietary
digestibility, 331
in Australia, relation to incidence of heart disease, SA129
in Framingham population, SA1
in the Bantu, 267
relation to cholesterol intake, in man, 42
relation to nitrogen release from liver, 183
relation to occurrence of gallstones, 25
requirements in the cold, 188
self-selection by soldiers, 77
type
effect on composition of adipose fat, 284
effect on development of obesity, 350
effect on plasma cholesterol levels, 68, 83
diglycerides, in plasma, for transport of fatty acids, 348
emulsions, use in parenteral nutrition, 164, 196
fatty acids
absorption
following gastrectomy, 9
relation to fecal cholesterol excretion, 81
deficiency, relation to occurrence of gallstones, 25
dietary, effect on cholesterol absorption, 168
effect on tryptic digestion of protein, N351
erucic acid, effect on fertility, 245
essential
deficiency
effect of trans acids on, 59
mitochondrial changes in, 86
discussion, SA33
in cell permeability, 116
in high versus low extraction flour, 144
interconversions, 55
role in reproductive functions, 245
infiltration of liver, in kwashiorkor, 36
plus cholesterol mixtures, toxicity of, 186
synthesis
effect of growth hormone on, 152
from acetate, in vitamin A deficiency, 17
transport mechanisms in plasma, 348
unesterified, metabolism of 102, 135
unsaturated
effect of on absorption of lipids, 186
in tissues, after peanut oil feeding, 89
effect on digestibility of fat, 331
volatile, use by ruminants, 207
in feces
following gastrectomy, 9
in idiopathic steatorrhea, relation to dietary wheat gluten, 234
intake, self-selection by soldiers, 77
liver
composition, in fat deficiency, 284
content
in obesity, 266
relation to caloric intake, 285
effect of dietary choline and protein on, 154
in cold environment, 188
metabolism, stimulation by ascorbic acid, in experimental atherosclerosis, 274
monoglycerides, in plasma, for transport of fatty acids, 348
necrosis of pancreas, prevention by Dextran, N95
peanut oil, in diet of chicks, effect on deposition of cholesterol in organs, 89
seed, mechanism of lowering serum cholesterol, 131
synthesis
from glucose or fructose, in the dairy cow, 172
from oleate, in cornea slices, 121
transport, role of unesterified fatty acids in, 102
Fava
bean, induction of hemolysis by, 323
Feather
pigmentation, in turkeys, need for lysine, 50
Feathering
in chicks, relation to cysteine synthesis, 241

Feces
calcium in, in hyperthyroidism, 269
cholesterol in
effect of ascorbic acid on, in experimental atherosclerosis, 274
relation to type of fatty acid fed, 81
excretory route for calcium, in man, N62
fat in
after feeding cholesterol-fatty acid mixtures, 186
following gastrectomy, 9
in idiopathic steatorrhea, relation to dietary wheat gluten, 234
measure of fat digestibility, 331
relation to type of dietary fat, 131
iodine in, relation to diet, 179
sterols in, in man, 168
thiamine in, of children, relation to thiamine intake, 198
vitamin B_{12} in, effect of intrinsic factor on, 307
Feeds
alfalfa (*see* **Alfalfa**)
barley, methods of increasing nutritional value, 108
efficiency, for swine, effect of lysine on, 15
pelleted, rumen parakeratosis from, 299
ruminants, factors contributing to bloat, 300
sheep
copper lack in, 78
salt needs in, N159
Feeding
artificial, of infants, in Africa, 238
chicks, breed differences in response to methionine, 241
children, in hot weather, N255
newborn infants, survey of practices, 233
patterns, in mice, technique for study, 58
Ferritin
in blood, in edema, N288
Fertility
effect of erucic acid on, 245
effect of pantothenic acid deficiency on, 305
Fertilizers
organic, versus inorganic, effect on nutrient value of crops, 97
Fetus
thyroid, fixation of maternal iodine, 52
Fever
from parenteral fat feeding, 164
Fish
herring, roe, provitamin D content, 16
nutritional requirements for, 106
oils, essential fatty acids in, SA33
protein source for treatment of Kwashiorkor, 259
Flour
extraction, effect on nutritive value, 144
Fluorescence
tissue, after tetracycline administration, 244
Fluoridation
water, significance for children, N191
Fluorine (*see* **Trace Elements**)
Fluoroacetate
effect on brain glutamic acid levels, SA161
Fluorodinitrobenzene
analysis of lysine in protein by, 344
Fluorohydrocortisone (*see* **Hormones**)
Fluorosis, 277
Folacin
deficiency, in fish, 106
in high versus low extraction flour, 144
metabolism, in sprue, 166
role in histidine biosynthesis, N127
treatment of idiopathic steatorrhea, 234
Food
acceptance patterns, in infants, 67
algae as source, 22
aluminum in, 23
energy content, measurement by rat growth method, 51
faddism
discussion, SA97
statement concerning, by the Food & Drug Administration, N191
habits, cultural factors in, SA257
industry, contribution to public health, SA225
intake
at low temperatures, 237
control by hypothalamus, 302
effect on water content of tissues, 53
in the Arctic, 202
of calves, relation to onset of reproductive activity, 209
of Cuban children, 271
of mice, patterns of, 58
relation to incidence of heart disease, SA1
irradiation, effect on nutritive value, 80
liquid formula, for weight reduction, 292
selenium in, 149
self-selection, by soldiers, 77
shortage, in Japan, relation to incidence of diabetes, 273
supply, dependence on insect control, SA289
surveys, under Committee on Nutrition for National Defense, SA193
Food & Drug Administration
statement by, concerning food faddism, N191
Food Values
energy content, rat growth method for measurement, 51
essential fatty acids, in various foods, SA33
protein, in barley, 108
pyridoxine, in human milk, 10
thiamine, in human milk, 44
Formaldehyde
combination with cysteine in metabolism, 82
Fortification
misuse of, SA97
Fourth International Congress of Nutrition, N99
Framingham Study
an epidemiological study of heart disease in Framingham, Massachusetts, SA1
Fructose (*see* **Carbohydrate**)
Fruit
citrus, self-selection by soldiers, 77
production, dependence on insect control, SA289

Gallstones
incidence, relation to diet, 25
Garlic
allithiamine in, 336
Gastric (*see* **Stomach**)
Gastric Juice
effect on vitamin B_{12} absorption, after gastrectomy, 307
Gastroenteritis (*see* **Disease**)
Gelatin
hydrolysates, effect on chick growth, 111
Geriatrics
lysine supplementation for the aged, 132
Gingivitis
in pregnant women, relation to ascorbic acid nutritional status, 6
Glucagon (*see* **Hormones**)

Glucose (*see* **Carbohydrate**)
Glucuronides
in urine, after consumption of groundnuts, 19
Glutamate (*see* **Amino Acids**)
Glutathione
glycine in, radioactivity, after injection of C^{14} glycine, 29
Glycerol
conversion to glycogen, effect of hydrocortisone on, 185
metabolism, in vitamin A deficiency, 17
Glycine (*see* **Amino Acids**)
Glycogen (*see* **Carbohydrate**)
Glycosides (*see* **Carbohydrate**)
Goat
calcium and strontium metabolism in, 315
Goiter (*see* **Thyroid**)
Gonadotrophin (*see* **Hormones**)
Groundnut
goitrogen in, 19
Growth (*see also* **Hormones**)
calves, in magnesium deficiency, 173
cells in culture, inositol, requirement for, 125
chicks
breed differences in response to methionine feeding, 241
effect of gelatin hydrolysates on, 111
children, effect of vitamin B_{12} on, N287
depression, from raw soybeans in diet, 242
factors
for bacteria, in protein digests, 190
for chicks, in protein hydrolysates, 111
for *P. pestis*, 21
identification, need for dietary control in, N31
pyridine derivatives as, 310
patterns, in children, 326
rate, relation to longevity, 350
response, of rats, as measure of food energy, 51
swine, effect of lysine on, 15
thermochemical efficiency of, 279
Guinea Pig
intestine, cholesterol to 7-dehydrocholesterol conversion in, 16
mineral metabolism in, 181
pyridoxal phosphate blood level in, 231

Hamster
experimental production of gallstones in, 25
Heart
action of serotonin on, in choline deficiency, 347
changes
from 6-mercaptopurine administration, 248
in a thiamine deficient infant, 240
cholesterol in, effect of feeding peanut oil on, 89
disease
Framingham epidemiological study, SA1
incidence in Australia, SA129
incidence in the Bantu, 267
relation to essential fatty acid deficiency, SA33
use of lipoprotein patterns in, 263
lesions, in dietary potassium deficiency, effect of digitalis on, 90
myocardial infarction, serum transaminase levels in, 204
potassium in, effect of digitalis on, 90
utilization of unesterified fatty acids, 102
Heat
effect on availability of lysine in proteins, 344
storage, by camel, 12
water requirements of infants and children during, N255

Heme
synthesis, in pyridoxine and pantothenic acid deficiency, 23, 142
Hemochromatosis
etiology of, SA353
Hemoglobin
levels
during weight reduction on liquid formula diet, 292
in Cuban children, 271
in infants with kwashiorkor, 36
in pregnancy, relation to ascorbic acid nutriture, 6
synthesis
effect of ascorbic acid plus vitamin E on, 113
effect of pantothenic acid and pyridoxine deficiency on, 23, 142
Hemorrhage
effect on phosphatase activity of white cells, 222
Hemosiderosis
in the Bantu, 267
Heparin (*see* **Drugs**)
Hereditary Glycinuria, 48
Heredity
differences in methionine utilization, in chicks, 241
diseases in children, 323
Histamine
effect on proteolytic activity of gastric juice, 137
Histidine (*see* **Amino Acids**)
Histology
thyroid, after consumption of arachidoside from groundnuts, 19
Homocysteine (*see* **Amino Acids**)
Homoserine (*see* **Amino Acids**)
Hormones
ACTH
effect on permeability of intestine to protein, 342
effect on phosphatase activity of white cells, 222
treatment of idiopathic steatorrhea, 234
cortisone
effect on bone and serum citrate levels, 247
effect on glycogen synthesis in vitamin A deficiency, 17
effect on permeability of intestine to protein, 342
effect on phosphatase activity of white cells, 222
epinephrine
effect on blood pressure, in experimental atherosclerosis in rabbits, 213
effect on muscle and liver glycogen, 185
estrogens, effect on permeability of intestine to protein, 342
fluorohydrocortisone, experimental diabetes from, in cats, 177
glucagon
effect on blood level of unesterified fatty acids, 135
effect on blood pepsinogen levels, 60
gonadotrophin, response in calves, relation to food intake, 209
growth
effect on fat synthesis, 152
from human pituitaries, 253
hydrocortisone
effect on glycogen formation from precursors, 185

effect on sulfate content of synovial fluid, 295
synthesis, genetic defects in, 323
hypothalamic, role in control of thirst, 302
insulin
effect on fatty acid synthesis, 152
effect on pentose metabolism, 200
effect on plasma level of unesterified fatty acids, 102, 135
labeled with I^{131}, physical and biological activity of, 283
male, activity, in the calf, relation to food intake, 209
parathyroid
effect on mast cells in bone, during rickets, 92
secretion in dairy cows, relation to dietary Ca:P ratio, 141
progesterone, effect on food intake and menstrual cycle in baboons, 145
secretin, effect on fat absorption following gastrectomy, 9
sympathin, in blood, effect of histidine feeding on, 213
testosterone, effect on proteinuria in rats, 337
thyroid
effect on calcium metabolism, 269
placental transfer, 52
synthesis, genetic blocks in, 323

Horse
species differences in body composition, 14

Hunger
on low caloric intake, 228
relation to blood glucose and amino acid levels, 7
relation to water content of adipose tissue, 53

Hydrocortisone (*see* **Hormones**)

Hydroxylation
lysine, in collagen synthesis, 340
proline, role of ascorbic acid in, 218

Hydroxylysine
in collagen synthesis, 340

Hydroxyproline (*see* **Amino Acids**)

Hydroxytryptamine
in urine, of patient with carcinoid tumors, 294

Hydroxytryptophan
intermediate in serotonin formation, 85, 294

Hypercalcemia
occurrence in hyperthyroidism, 269

Hyperoxaluria
primary, kidney stones in, 75

Hyperphagia
in mice, effect on feeding pattern, 58

Hypertension
Framingham epidemiological study, SA1
methionine sulphoxide as an etiologic agent, 87

Hyperthyroidism
calcium metabolism in, 269

Hypothalamic (*see* **Hormone**)

Hypothalamus
glucoreceptor, control of appetite, 7
thirst control by, 302

Hypothyroidism
effect on production of essential fatty acid deficiency, SA33

Immunity
in infants, breast-fed versus artificial, 261

Indican
in urine, effect of raw soybean diet on, 242

Infants
African, effect of artificial feeding on, 238
amino acid excretion in, 5
beriberi in, relation to thiamine in human milk, 44
breast-feeding,
effect on immunity, 261
incidence in the U. S., N351
chronic malnutrition in, electrolyte changes in, 99
dermatitis in
from urine, effect of methionine feeding on, 105
in essential fatty acid deficiency, SA33
epileptiform seizures in, in pyridoxine deficiency, SA161
feeding, in hot weather, N255
fluid intake of, N191
food acceptance patterns in, 67
high birth weight, association with diabetes in mother, 296
iron absorption in, 170
kwashiorkor in, laboratory studies of, 36
newborn, feeding formulas for, 233
pyridoxine requirements for, 10
thiamine deficiency in, 240

Infection
effect of dietary methionine and tryptophan on, 313
effect on phosphatase activity of white cells, 222
in children, relation to protein intake, 326
in infants relation to breast versus artificial feeding, 238, 261

Inositol
deficiency, in fish, 106
requirements, for cells in culture, N95, 125, SA321

Insects
control, discussion, SA289

Insulin (*see* **Hormones**)

Interdepartmental Committee on Nutrition for National Defense, SA193

International Congress of Nutrition, N94

Intestine
absorption (*see* **Absorption**)
bacteria
role in ascorbic acid effect on pantothenic acid deficiency, 305
effect of sorbitol on, 126
cholesterol absorption in, effect of diet on, N31
disease, uropepsin levels in, 137
guinea pig, cholesterol to 7-dehydrocholesterol conversion in, 16
human, in tissue culture, inositol requirements for, N95
mucosa
changes
from 6-diazo-5-oxo-2-norleucine (DON), 248
from 6-mercaptopurine administration, 248
radioactivity in, after administration of C^{14} tryptophan, N223
nitrogen disappearance from, after feeding different proteins, 334
provitamin D in, 16
putrefaction in, effect of raw soybean diet on, 242
ulcerative colitis, myocardial lesions in, 90

Intravenous Feeding
amino acids, effect on appetite, 7

Intrinsic Factor
effect on absorption of vitamin B_{12}, 307
species specificity of, 307
treatment of pernicious anemia, refractory state, 235

Iodine (*see* **Trace Elements**)
Iran
nutrition survey in, SA193
Iron
absorption
effect of ascorbic acid plus vitamin E on, 113
in infants and children, 170
deficiency
anemia, in Africa, 330
without anemia, cytochrome C levels in, 155
intake
in pregnancy, relation to ascorbic acid nutrition, 6
of Cuban children, 271
metabolism
in protein deficiency, 251
in the Bantu, 267
needs, contribution of bread to, in World War II, 144
sources, in infants' diets, 67
turnover, in cells, SA353
Irradiation
food, effect on protein quality, 80
from radiostrontium, in bone, effect of dietary calcium on, 153
Isocholesterol
effect on cholesterol absorption, 331

Japan
food shortage in, relation to incidence of diabetes, 273
incidence of gallstones in, 25

Ketoglutarate
effect on tyrosine oxidation by liver, in protein deficiency, 216
α-Ketoglutarate
metabolism, in brain, SA161
Ketosis
blood level of unesterified fatty acids in, 135
effect of ascorbic acid on, in experimental atherosclerosis, 274
from butyrate feeding, effect of oxalacetate and citrate on, 312
from low-calorie, exercise program for weight reduction, 228
in a thiamine deficient infant, 240
in diabetes
effect of aspirin on, 167
effect of glucose versus fructose on, 70
Kidney
action of serotonin on, in choline deficiency, 347
calcium clearance
in hyperthyroidism, 269
effect of vitamin D on, 205
changes, in essential fatty acid deficiency, SA33
chronic disease, protein requirements in, 329
cytochrome-c, in iron deficiency without anemia, 155
effect of long term ingestion of fluoride on, 117
function
in chronic infantile malnutrition, 99
in Fanconi's syndrome, 39
in hereditary glycinuria, 48
metabolism, production of hypertensive agents, 87
phosphate clearance, effect of cortisone on, 247
protein clearance, in rats, 337
stones, in primary hyperoxaluria, 75
strontium clearance, 315
vitamin B_{12} in, effect of intrinsic factor on, 307
Korea
nutrition survey in, SA193
Kwashiorkor
laboratory studies in, 36
psychological changes accompanying, SA257
treatment and prevention, 259

Lactate
blood level
effect of epinephrine and hydrocortisone on, 185
effect of pentose administration on, 200
metabolism, in vitamin A deficiency, 17
Lactation
amino acid requirements for, 313
calcium and strontium secretion in milk, 315
performance, of the Bantu, 267
relation to blood ascorbic acid levels, 6
relation to dietary Ca:P ratios, 141
Lactose (*see* **Carbohydrate**)
Lead
poisoning, aminoaciduria in, 39
Legumes
in feeds for ruminants, bloat from, 300
Letters to the Editor
Altschul, R., 96
Bronner, F., 62
Cartwright, K. L., 319
Forbes, R. M., 224
Harris, R. S., 62
Hoffer, A., 96
Ivy, A. C., 31
Karvinen, E., 31
Lin, T. M., 31
McClymont, G. L., 159
Moore, J. H., 31
Taylor, T. G., 31
Walker, A. R. P., 31
Leukocytes (*see* **Blood**)
Libya
nutrition survey in, SA193
Lipogenesis
in cornea slices, 121
Lipoprotein
blood levels, relation to iodine number of fatty acids fed, 81
fractions, in atherosclerosis, 263
Lipotropic
factors
relation to blood phospholipid levels, 154
symposium on, 352
Liver
carcinogenic effect of maleic hydrazide, 217
carotenoid stores in, N192
changes
from 6-mercaptopurine administration, 248
from N-methyl-formamide, 248
from parenteral fat emulsions, 164
in a thiamine deficient infant, 240
in infants with kwashiorkor, 36
cholesterol, effect of feeding peanut oil on, 89
cholesterol synthesis in, effect of dietary cholesterol on, 110
cirrhosis
portal vein pressure in, 298
thyroid uptake in, 179
cysteine after methionine administration to chicks, 241
cytochrome-c, in iron deficiency without anemia, 155

disease
in megaloblastic anemia, 330
serum transaminase levels in, 204
plasma amino acid levels in, 73
vitamin B_{12} metabolism in, 230
DPN, after feeding pyridine derivatives, 310
effect of serotonin on, in choline deficiency, 347
fat
after feeding cholesterol-fatty acid mixtures, 186
composition, in fat deficiency, 284
content, relation to caloric intake, 285
effect of cold environment, 188
synthesis from acetate, in vitamin A deficiency, 17
fatty acid synthesis in, effect of growth hormone on, 152
function
during weight reduction on liquid formula diet, 292
in obesity, 266
in the Bantu, 267
vitamin B_{12} excretion test, 230
glycine, radioactivity, after injection of C^{14} glycine, 29
glycogen
effect of epinephrine on, 185
synthesis from acetate, in vitamin A deficiency, 17
hemosiderosis in the Bantu, 267
human, in tissue culture, inositol requirements for, N95
hydroxytryptophan decarboxylase in, 85
incorporation of iron, in protein deficiency, 251
microsomes, protein synthesis in, in vitamin B_{12} deficiency, 252
necrosis
from feeding mushroom, 220
prevention by vitamin E or Factor 3, 149
nitrogen release from, in fasting, 183
nucleic acid content, after feeding maleic hydrazide, 217
phospholipids, effect of dietary choline and protein on, 154
potassium, effect of digitoxin on, 90
protein, level, relation to caloric intake, 285
protein synthesis in, in protein deficiency, 216
radioactivity, after administration of C^{14} tryptophan, N223
role in metabolism of unesterified fatty acids, 102
siderosis, relation to diet, SA353
transamination activity in, in protein deficiency, 216
turnover of vitamin B_{12} in, 325
vitamin B_{12}, effect of intrinsic factor on, 307
weight, relation to caloric intake, 285

Longevity
relation to amino acid nutrition, 313
relation to growth rate, 350

Lung
cholesterol in, effect of feeding peanut oil on, 89
effect of aluminum on, 23

Lysine (*see* **Amino Acids**)

Magnesium
deficiency, in calves, 173
requirements, for the guinea pig, 181

Malate
conversion to glycogen, effect of hydrocortisone on, 185
effect on bacterial growth, 116

Maleic Hydrazide
carcinogenic effect of on rat liver, 217

Malnutrition
chronic, electrolyte changes in, 99
edema from, ferritin in blood, N288
effect on behavior, SA257
effect on siderosis, SA353
in baboons, effect on menstrual cycle, 145
incidence of diabetes in, 273
Kwashiorkor, in South African infants, 36

Manganese (*see* **Trace Elements**)

Mast Cells
counts, in calcium deficiency, 92

Maternal Nutrition
passage of iodine through placenta, 52
pyridoxine requirements in, 10
role of ascorbic acid in, 6

Meat
consumption, effect on portal vein pressure, in liver cirrhosis, 298
essential fatty acids in, SA33
intake, self-selection by soldiers, 77
introduction into infants' diets, 67

Megimide (*see* **Drugs**)

Menstruation
metabolic changes, in the baboon, 145

Mental Disease
and nutrition, SA257
role of serotonin in, 85

Metabolic Rate (*see* **Basal Metabolic Rate**)

Methionine (*see* **Amino Acids**)

Methionine Sulphoxide
hypertensive agent, 87

Metrazole (*see* **Drugs**)

Mexico
chronic infantile malnutrition in, electrolyte changes in, 99

Mice
feeding patterns, technique for study, 58
proteinuria in, 337

Microsomes
protein synthesis in, in vitamin B^{12} deficiency, 252

Milk
calcium and strontium in, 315
consumption
effect on iron absorption in children, 170
of children, N191, 271
cows' versus mothers' in infant feeding in Africa, 238
evaporated versus fresh, in formulas for feeding newborn infants, 233
human
antibodies in, 261
pyridoxine content of, 10
thiamine in, 44
intake, self-selection by soldiers, 77
irradiation, effect on protein quality, 80
protein
biologic value, 220
efficiency ratio, 56
lysine in, availability of lysine in, 344
of Bantu mothers, 267
radioactivity in, after injection in cow of C^{14} glucose or fructose, 172

Minerals
bone
effect of cortisone and vitamin D on, 247
effect of thyroid hormone on, 269
in experimental rickets in cats, 140
in fluorosis, 277
dietary, relation to production of gallstones in hamsters, 25

Minerals—(*Continued*)
metabolism, in guinea pigs, 181
requirements, for HeLa cells in tissue culture, SA321
Minnesota
diet survey of cholesterol intake, 42
Mitochondria
changes in, in essential fatty acid deficiency, 86
Molybdenum (*see* **Trace Elements**)
Monkey
pyridoxal phosphate blood level in, 231
Mortality (*see* **Death Rate**)
Mucopolysaccharide
changes, in ground substance, in experimental atherosclerosis in rabbits, 211
Muscle
composition, changes in chronic infantile malnutrition, 99
development, measure of protein requirements in children, 326
dystrophy, electrolyte changes in, 71
glycine, radioactivity, after injection of C^{14} glycine, 29
glycogen, effect of epinephrine on, 185
radioactivity in, after administration of C^{14} tryptophan, N223
uptake of glucose
activity of I^{131}-insulin on, 283
effect of aspirin on, 281
Mushroom
protein, inadequacy of, 220

National Defense
Interdepartmental Committee on Nutrition for, SA193
Nerve
changes
effect of long term ingestion of fluoride, 117
in a thiamine deficient infant, 240
function, in pyridoxine deficiency, SA161
symptoms, in pyridoxine deficiency, relation to serotonin, 85
Neurosis
in food preferences, SA97
Niacin
deficiency
effect of pyridine derivatives on, 310
in Cuban children, 271
in fish, 106
in the Bantu, 267
formation, from tryptophan, in the duck, 310
in yeast, relation to nitrogen content of growth medium, 147
needs, contribution of bread to, in World War II, 144
Nitrogen
balance
after surgery, 196
during exercise program for weight reduction, 228
effect of growth hormone on, 253
effect of parenteral fat feeding on, 164
in children, effect of 6-mercaptopurine on, 248
in chronic renal disease, 329
of the aged, effect of lysine supplementation on, 132
on plant versus animal protein diet, 220
on rice diet, effect of amino acid supplementation on, 46
relation to caloric intake, 285
relation to riboflavin excretion, 198
disappearance, from intestine, after feeding different proteins, 334
in growth medium of yeast, effect on vitamin synthesis, 147
in urine, relation to caloric intake, 285
non-protein
blood level
in a thiamine deficient infant, 240
in tryptophan deficiency, N287
release from liver, in fasting, 183
utilization, in children, 326
Notes
American Board of Nutrition, 62
Appetite Stimulation in Children, 287
Breast Feeding in the United States, 351
Carotene, 20,000 Years Old, 127
Carotenoid Stores in Man, 192
Fat Metabolism and Diabetes, 320
Fatty Acids and Protein Digestion, 351
Ferritin and Nutritional Edema, 288
The Fluid Intake of Small Children, 191
Folacin and Histidine Biosynthesis, 127
Food Faddism, 191
The Fourth International Congress of Nutrition: A Report, 94
Gordon Research Conferences, 128
Hot Weather Feeding of Children and Infants, 255
Inositol Requirement of Isolated Human Cells, 95
Lipotropic Factors, 352
Metabolic Effects of Amino Acid Deficiency, 287
Nutrition and Pediatrics, 160
The Nutrition Society of Canada, 320
Prevention of Pancreatic Fat Necrosis by Dextran, 95
Third Inter-African Conference on Nutrition, 63
Uptake of Radioactive Tryptophan by Malignant Carcinoid Tumor, 223
Vitamin D and Atherosclerosis, 159
Nucleic Acid
changes
in cell content, from 6-mercaptopurine, 248
in oocytes, in protein deficiency, 304
in liver, from animals fed maleic hydrazide, 217
Nutrition
and behavior, SA257
and chronic disease control, SA225
and climatic stress, 188
education
for the physician, to combat food faddism, SA97
program of the American Medical Association, SA65
Interdepartmental Committee on, for National Defense, SA193
pediatrics, 160
relation to reproduction, 209
Nutrition Surveys
ascorbic acid nutriture in pregnant women, 6
Committee on Nutrition for National Defense, SA193
Cuban children, 271
diet and heart disease, Framingham study, SA1
food patterns of infants, 67
in Africa, N63
in the Arctic, 202
of cholesterol intake and atherosclerosis, 42
of the Bantu, 267

Nuts
groundnuts, goitrogen in, 19

Obesity
from high fat diet, relation to type of fat, 350
in mice, feeding patterns and habits, 58
liver function in, 266
psychological basis, SA97
reduction
exercise for, 228
with liquid formula diets, 292
relation to atherosclerosis, SA129
relation to incidence of heart disease, SA1
research in, SA225
Occupation
relation to coronary heart disease, in Australia, SA129
Orange
juice, consumption, of children, N191
Osteomalacia (*see* **Bone**)
Ovarian Cycle
of the baboon, relation to diet, 145
Ovary
changes in, in protein deficiency, 304
Ovulation
in baboons, effect of malnutrition on, 145
Oxalacetate
effect on ketosis, 312
Oxalate
dietary, effect on calcium absorption, 148
primary hyperoxaluria, oxalate metabolism in, 75
Oxidation
acetate, in vitamin A deficiency, 17
biological, possible role of selenium in, 149, 174
carbohydrate, effect of growth hormone on, 152
essential fatty acids, 55
fructose, in the dairy cow, 172
in muscle, effect of aspirin on, 281
lactate, effect of hydrocortisone on, 185
mitochondrial, in essential fatty acid deficiency, 86
pentose, in man, 200
tyrosine, in liver, in protein deficiency, 216
Oxidative Phosphorylation
in muscle, effect of aspirin on, 281
Oxygen
lack, effect on iron metabolism, SA353

Pakistan
nutrition survey in, SA193
Pancreas
changes, in fluorohydrocortisone diabetes, in cats, 177
fat necrosis, prevention by Dextran, N95
fibrocystic disease, genetic origin, 323
function, relation to gastric ulcers, 60
preparation, feeding of, effect on fat absorption following gastrectomy, 9
Pantothenic Acid
deficiency
effect of ascorbic acid on, role of intestinal bacteria, 305
heme synthesis in, 23
in fish, 106
porphyrin synthesis in, 142
in high versus low extraction flour, 144
in yeast, relation to nitrogen content of growth medium, 147
Parakeratosis
rumen, from pelleted feeds, 299
Parathyroid (*see also* **Hormones**)
role in renal phosphate metabolism, 205, 247
Parenteral Nutrition
fat emulsions, use, 164
Pathology
acetylated fat poisoning, 317
aluminum poisoning, 23
copper deficiency in sheep, 78
essential fatty acid deficiency, SA33
experimental xanthomatosis in rabbits, 211
fluorohydrocortisone diabetes, in cats, 177
hereditary glycinuria, 48
kidney, in aminoacidurias, 39
maleic hydrazide poisoning, 217
mercaptopurine poisoning, 248
selenium poisoning, 174
thiamine deficiency in infants, 240
Wilson's disease, 37
Peanut
goitrogenic factor from, 19
oil, dietary, in chicks, effect on cholesterol deposition, 89
protein source for treatment of kwashiorkor, 259
Pellagra
subclinical, in Cuban children, 271
Penicillin (*see* **Drugs**)
Pentose (*see* **Carbohydrate**)
Peptides
excretion, relation to copper excretion, 37
as growth factors, 111, 190
Permaquine (*see* **Drugs**)
Permeability
bacteria, effect of unsaturated fatty acids on, 116
cell, use of pentose in determination of, 200
placenta and intestinal mucosa, to protein, 342
Phenobarbital (*see* **Drugs**)
Phenylalanine (*see* **Amino Acids**)
Philippines
nutrition survey in, SA193
Phospholipid
blood level
effect of dietary choline and protein on, 154
in rabbits with experimental xanthomatosis, 211
fractions, in atherosclerosis, 263
liver, after feeding cholesterol-fatty acid mixtures, 186
role in transport of fatty acid, 348
substrate for lipogenesis in cornea slices, 121
synthesis, in liver, effect of growth hormone on, 152
Phosphorus
absorption, effect of aluminum hydroxide on, 23
balance
in children, effect of 6-mercaptopurine on, 248
effect of growth hormone on, 253
blood levels
in experimental rickets in cats, 140
in magnesium deficiency in calves, 173
deficiency, mast cell counts during, 92
dietary, relation to calcium metabolism in the dairy cow, 141
in muscle, in muscular dystrophy, 71
in urine
effect of vitamin D on, 205
in Wilson's disease, 39
needs, contribution of bread to, in World War II, 144
phosphate, dietary, effect on fat absorption, 331
renal clearance, effect of cortisone on, 247
requirement, for the guinea pig, 181

Phosphorylation
oxidative, in essential fatty acid deficiency, 86
Phytate
effect on iron absorption in children, 170
for growth of cells in culture, 125
Pig (*see* **Swine**)
Pigmentation
feather, in turkeys, need for lysine in, 50
Pituitary
anterior, role in control of water consumption, 302
growth hormone
effect of on fat synthesis, 152
species differences in activity, 253
Placenta
permeability
to iodine, 52
to protein, 342
Plants
goitrogens in, 19
selenium as essential growth factor, 174
Porphyrin
synthesis, in pyridoxine and pantothenic acid deficiency, 142
Potassium
balance, effect of growth hormone on, 253
deficiency, in chronic infantile malnutrition, 99
in heart muscle, effect of digitalis on, 90
in muscle
effect of aspirin on, 281
in muscular dystrophy, 71
loss, in diabetic acidosis, effect of glucose versus fructose therapy on, 70
metabolism, effect of parenteral fat feeding on, 164
requirements, for the guinea pig, 181
treatment of kwashiorkor, 259
Poultry
feeding, breed differences in, 241
feeds, raw soybeans in, effect on egg production, 242
Pregnancy
blood ascorbic acid levels in, 6
glucose tolerance tests following, 296
relation to occurrence of gallstones, 23
Premature Births
and ascorbic acid intakes of pregnant women, 6
Progesterone (*see* **Hormones**)
Proline (*see* **Amino Acids**)
Protein
biologic value
algae, 22
bacterial, 115
plant versus animal, 220
ceruloplasmin deficiency, in Wilson's disease, 37
colostral, absorption by calf, 342
corn, zein, in vivo digestion of, 334
defects, in muscular dystrophy, 71
deficiency
effect on nucleic acid of oocytes, 304
effect on protein synthesis and transamination, 216
ferritin in blood, N288
in children, treatment and prevention, 259
iron metabolism in, 251
kwashiorkor, in South African infants, 36
dietary
effect on blood phospholipid levels, 154
effect on fat digestibility, 331
effect on portal vein pressure, in liver cirrhosis, 298
effect on proteinuria, in rats, 337
relation to nitrogen release from liver, 183
relation to urinary excretion of amino acids, 5
requirements in the cold, 188
restriction, for weight reduction, 292
digestion
by trypsin, effect of fatty acid on, N351
in vivo, 334
efficiency ratio, assessment of, 56
gamma globulin, in serum of infants, breast versus artificially fed, 261
globulin
blood level, in tryptophan deficiency, N287
direct utilization by HeLa cells, in tissue culture, SA321
in urine of rats and mice, 337
hydrolysates
effect on chick growth, 111
in treatment of kwashiorkor, 259
intravenous feeding, effect on nitrogen balance after feeding, 196
in urine
of infants with Fanconi's syndrome, 39
of rats and mice, 337
intake
effect on protein efficiency ratio, 56
effect on thermochemical efficiency, 279
of infants, 67
of the Bantu, 267
relation to pyridoxine deficiency, in infants, 10
self-selection by soldiers, 77
irradiation, effect on nutritive value, 80
liver
relation to caloric intake, 285
synthesis from acetate, in vitamin A deficiency, 17
lysine in, availability of, 344
malnutrition, effect on behavior, SA257
mushroom, inadequacy of, 220
needs, contribution of bread to, in World War II, 144
permeability to, in placenta and intestinal mucosa, 342
release, from liver, in fasting, 183
requirements
for children, 326
in chronic renal disease, 329
rice, supplementation of with amino acids, 46
serum
changes with menstrual cycle in baboons, 145
during weight reduction on liquid formula diet, 292
in anemias, 330
pattern
in kwashiorkor, 259
in pantothenic acid deficiency, 305
soluble, in animal feeds, relation to production of bloat, 300
soyin, in raw soybeans, 242
synthesis
effect of protein deficiency on, 216
from glutamine, by HeLa cells in tissue culture, 157
in muscle, effect of aspirin on, 281
rates, in different tissues, 29
role of vitamin B_{12} in, 252
vitamin B_{12} binding by, effect on vitamin B_{12} metabolism, 307
wheat, relation to idiopathic steatorrhea, 234
Provitamin D (*see* **vitamin D**)
Public Health
contribution of food industry to, SA225
Framingham Study of heart disease, SA1

insecticides, hazards of, SA289
nutrition surveys in Africa, N63, 267
programs in nutrition, under Committee on Nutrition for National Defense, SA193
survey
of formula types for feeding newborn infants, 233
of heart disease in Australia, SA129
water fluoridation, long term effects, 117
Purines
adenine, to reverse growth inhibition by aminopterin, N127
Pyridine
derivatives, activity in replacing niacin, 310
Pyridoxal (*see* **Pyridoxine**)
Pyridoxal Phosphate (*see* **Coenzymes**)
Pyridoxine
deficiency
cerebral activity in, SA161
heme synthesis in, 23
in fish, 106
porphyrin synthesis in, 142
tissue serotonin levels in, 85
dietary, relation to blood pyridoxal phosphate level, 231
in high versus low extraction flour, 144
in human milk, 10
in yeast, relation to nitrogen content of growth medium, 147
metabolism, in infants, 10
requirement, for infants, 10
role in cystathionine metabolism, 178
Pyruvate
blood levels, after pentose administration, 200
fatty acid synthesis from, effect of growth hormone on, 152

Rabbit
experimental atherosclerosis in,
effect of fatty acids on, 81
treatment with histidine, 213
experimental gallstones in, 25
experimental xanthomatosis in, 211
pyridoxal phosphate bloods level in, 231
Radiostrontium
retention, effect of dietary calcium on, 153
Reproduction
activity, in the calf, relation to food intake, 209
amino acid requirements for, 313
effect of erucic acid on, 245
in baboons, effect of malnutrition on, 145
in essential fatty acid deficiency, SA33
in pathothenic acid deficiency, 305
ovarian changes, in protein deficiency, 304
Requirements
amino acids
for *P. pestis*, 21
in reproduction and lactation, 313
calcium, discussion, N31
caloric, at low temperatures, 202, 237
dietary, in the cold, 188
essential fatty acids
effect of trans-acids on, 59
for various species, SA33
inositol, for cells in culture, N95, 125, SA321
lysine
for swine, 15
for women, 132
minerals, for the guinea pig, 181
protein
for children, 326
in chronic renal disease, 329
during weight reduction, 292
pyridoxine, for infants, 10
vitamins, for fish, 106
water
and salt, for children, in hot weather, N255
for the camel, 12
Respiratory Quotient
in adrenalectomized rats, 185
during low-calorie, exercise program for weight reduction, 228
Riboflavin
deficiency, in fish, 106
in urine
as index of riboflavin deficiency, SA193
of children, 198
in yeast, relation to nitrogen content of growth medium, 147
intake, of Cuban children, 271
needs, contribution of bread to, in World War II, 144
nutrition, in foreign Armed forces, SA193
Rice
supplementation with amino acids, 46
Rickets
calcium-phosphorus relations in, 205
experimental, in cats, 140
from fluorosis, in swine, 277
mast cell counts in bone during, 92
occurrence in sheep, 16
Rumen
parakeratosis, from pelleted feeds, 299
Ruminants
bloat in, dietary factors involved, 300
copper deficiency in, 78
utilization of bacterial proteins by, 115
utilization of volatile fatty acids by, 207
Russia
research on experimental atherosclerosis, 274

Salmon
nutritional requirements for, 106
Salt
loss, in fibrocystic disease, 323
needs, in sheep feeding, N159
Saponin
in feeds for ruminant, relation to production of bloat, 300
Sardinia
diet survey of cholesterol intake, 42
Scurvy
collagen formation in, 218
Secretin (*see* **Hormones**)
Seed
fats, mechanism of lowering serum cholesterol, 131
Selenium (*see* **Trace Elements**)
Selenocystathionine
for prevention of exudative diathesis in chicks, 174
Self-Selection
foods
food faddism, discussion, SA97
by soldiers, 77
Semicarbazide
toxicity, relation to γ-aminobutyrate metabolism in brain, SA161
Serine (*see* **Amino Acids**)
Serotonin
formation from tryptophan, 85
metabolism, in patients with carcinoid tumor, N223
toxic actions of, 347

Sex
development
in protein starvation, 304
in the calf, relation to food intake, 209
Sex Differences
in lipoprotein patterns, 263
in nitrogen balance, after surgery, 196
in occurrence of gallstones, 23
in production of fatty acid deficiencies, SA33
in proteinuria in mice and rats, 337
Sheep
copper deficiency in, 78
feeding, salt needs in, N159
feeds, pelleted, rumen parakeratosis from, 299
utilization of lower fatty acids by, 207
vitamin D sources for, 16
Sitosterol
dietary effect on plasma cholesterol level, 68
Skeleton
age, evaluation by X-ray, 101
changes in fluorosis, 277
Skin
changes
from serotonin, in choline deficiency, 347
in essential fatty acid deficiency, SA33
in experimental xanthomatosis in rabbits, 211
in fluorohydrocortisone diabetes, in cats, 177
changes, in fluorosis, 277
in infants, in essential fatty acid deficiency, SA33
in kwashiorkor, 36
collagen, hydroxylysine in, 340
composition, changes in chronic infantile malnutrition, 99
dermatitis, from urine, effect of methionine feeding on, 105
hydroxyproline in, in ascorbic acid deficiency, 218
provitamin D in, 16
water content, changes after food consumption, 53
Smoking
relation to atherosclerosis, SA1, SA129
Sodium
balance, studies in the guinea pig, 181
changes, in chronic infantile malnutrition, 99
in heart muscle, in heart failure, 90
in muscle, in muscular dystrophy, 71
loss
in diabetic acidosis, effect of glucose versus fructose on, 70
in fibrocystic disease, 323
metabolism, effect of parenteral fat feeding on, 164
requirements, of children, in hot weather, N255
Soil
aluminum content, 23
Sorbitol
utilization, in thiamine deficiency, 126
Soybeans (*see* **Vegetable**)
Special Articles
Brozek, J., Nutrition and Behavior, 257
Burney, L. E., Nutrition and Chronic Disease Control, 225
Dawber, T. R. and Kannel, W. B., An Epidemiologic Study of Heart Disease: The Framingham Study, 1
Decker, G. C., Insect Control vs. Human Nutrition, 289
Geyer, R. P., Nutrition of Mammalian Cells in Tissue Culture, 321
Gillman, T., Cell Enzymes and Iron Metabolism in Anemias and Siderosis, 353
Hipsley, E. H., Coronary Heart Disease in Australia, 129
Holman, R. T., Essential Fatty Acids, 33
Olson, R. E., Food Faddism—Why?, 97
Schaefer, A. E., Interdepartmental Committee on Nutrition for National Defense, 193
Tower, D. B., Pyridoxine and Cerebral Activity, 161
White, P. L., The Program of the Council on Foods and Nutrition of the American Medical Association, 65
Species Differences
absorption of ergosterol, 16
activity of intrinsic factor, 235
biologic value of bacterial proteins, 115
body composition, of horses, 14
growth hormone activities, 253
intrinsic factor activity, 307
pyridoxal phosphate blood level, 231
requirements of essential fatty acids, SA33
Sperm
formation, in the calf, relation to food intake, 209
Spermine
growth factor for *L. casei*, 190
Spleen
cholesterol in, effect of feeding peanut oil on, 89
hemosiderosis, in the Bantu, 267
incorporation of iron, in protein deficiency, 251
microsomes, protein synthesis in, in vitamin B_{12} deficiency, 252
Sprue (*see* **Disease**)
Starvation
effect on behavior, SA257
effect on incidence of diabetes in Japan, 273
effect on renal effects of cortisone, 247
effect on utilization of lower fatty acids by sheep, 207
nitrogen release from liver in, 183
Steatorrhea
following gastrectomy, 9
idiopathic, treatment by exclusion of dietary wheat gluten, 234
Sterol
in feces
in man, 168
relation to type of dietary fat, 131
Stomach
disease, uropepsin levels in, 137
gastrectomy, effect on vitamin B_{12} absorption, 307
horse, provitamin D content, 16
nitrogen disappearance from, after feeding different proteins, 334
secretion, effect of glucagon on, 60
surgery
nitrogen balance after, 9, 196
serum transaminase levels following, 204
ulcer, relation to glucagon, 60
Storage
carotenoids, in human tissue, N192
copper, in ruminants, 78
stability of carotene in fossil sediments, N127
Strepogenin
as growth factor, 111
Stress
climatic, effect on dietary requirements, 188
effect on phosphatase activity of white cells, 222
effect on production of essential fatty acid deficiency, SA33
relation to atherosclerosis, SA129
Strontium
retention, effect of dietary calcium on, 153

rickets, mast cell counts during, 92
secretion in milk, 345
Strychnine (*see* **Drugs**)
Succinate
heme synthesis from, in pantothenic acid and pyridoxine deficiencies, 23
incorporation into hemin, in pyridoxine and pantothenic acid deficiencies, 142
oxidation, by liver mitochondria from essential fatty acid deficient rats, 86
Sulfhydryl
metabolism, significance of thiazolidine carboxylic acid in, 82
Sulfur
sulfate
in synovial fluid and blood, in disease, 295
relation to copper nutrition, 78
transfer
role of pyridoxine in metabolism, 178
Sunflower
seed oil, dietary, effect on sterol and bile acid excretion, 131
Supplementation
food, misleading promotion of by food faddists, N191
lysine, use in gerontology, 132
sulfur-amino acids, of poultry rations, 241
Surgery
gastrectomy
effect on vitamin B_{12} absorption, 307
steatorrhea following, 9
nitrogen metabolism after, 196
of aged, use of dietary lysine supplementation in, 132
pancreatic, use of dextran in management, N95
serum transaminase levels following, 204
use of parenteral fat emulsions in, 164
Sweat
losses, of children, in hot weather, N255
Swine
aortic lesions in, in essential fatty acid deficiency, SA33
lysine requirements for, 15
Sympathin (*see* **Hormones**)
Synovial Fluid
sulfate content, in disease, 295
Synthesis
amino acids, in *P. pestis*, 21
blood proteins, in pantothenic acid deficiency, 305
carnitine, in the chick embryo, 214
cholesterol
effect of dietary cholesterol on, 110
effect of fatty acid feeding on, 81
effect of growth hormone on, 152
from acetate, in vitamin A deficiency, 17
collagen
in ascorbic acid deficiency, 218
lysine hydroxylation in, 340
cysteine, in chicks, genetic differences in, 241
fat, from oleate, in cornea slices, 121
fatty acids, effect of growth hormone on, 152
heme, in pantothenic acid and pyridoxine deficiencies, 23
hemoglobin, effect of ascorbic acid plus vitamin E on, 113
histidine, role of folacin in, N127
hydrocortisone, genetic defects in, 323
nucleic acids, in the ovary, in protein synthesis, 304
phospholipid, effect of growth hormone on, 152
porphyrins, in pyridoxine and pantothenic acid deficiency, 142
pressor substances, in kidney, from methionine, 87
protein
from glutamine, by HeLa cells in tissue culture, 157
in muscle, effect of aspirin on, 281
in protein deficiency, 216
in various tissues, 29
role of vitamin B_{12} in, 252
thiamine, intestinal, effect of sorbitol on, 126
thyroid hormone, genetic blocks in synthesis, 323
vitamins, in yeast, relation to nitrogen content of growth medium, 147

Teeth
caries, effect of long term ingestion of fluoride on, 117
mottling, effect of long term ingestion of fluoride on, 117
Temperature
body
of camel, fluctuations in, 12
premenstrual changes in, 145
high, water requirements of infants and children during, N255
low
dietary requirements in, 188
effect on caloric intake, 202, 237
Testes
changes
after erucic acid feeding, 245
in pantothenic acid deficiency, 305
Testosterone (*see* **Hormones**)
Tetracycline (*see* **Drugs**)
Thermochemical Efficiency, 279
Thiamine
blood levels, after giving allithiamine, 336
deficiency
in fish, 106
in infants, 240
sorbitol utilization in, 126
dietary, effect on thiamine content of mothers' milk, 44
feeding, effect on dermatitis from ammoniacal urine, 105
formation from allithiamine in garlic, 336
in human milk, 44
in urine of children, 198
intake, of Cuban children, 271
needs, contribution of bread to, in World War II, 144
stimulation of appetite in children, N287
synthesis, intestinal, effect of sorbitol on, 126
Thiazolidinecarboxylic Acid
product of cysteine metabolism, 82
Third Inter-African Conference on Nutrition, N63
Thirst
control, by the hypothalamus, 302
Threonine (*see* **Amino Acids**)
Thymol Turbidity Test
in obesity, 266
Thyroid (*see also* **Hormones**)
effect of long term ingestion of fluoride on, 117
fetal, fixation of maternal iodine, 52
function, relation to diet, 179
goitrogens, in groundnuts, 19
hormone
effect on calcium metabolism, 269
synthesis, genetic blocks in, 323
Tissue
adipose

Tissue—(*Continued*)
carotenoid storage in, N192
composition, effect of dietary fat on, 284
lipogranulomas in, from dietary acetylated fats, 317
aluminum in, 23
composition, changes in chronic infantile malnutrition, 99
connective
in experimental atherosclerosis in rabbits, 211
mast cell counts in, during calcium deficiency, 92
culture, nutritional requirements for, N95, 157, SA321
fluorescence, after tetracycline administration, 244
in cell culture, inositol requirements for, 125
protein synthesis rates in, 29
water content, relation to food intake, 53
Tobacco
use of, relation to incidence of heart disease, SA1, SA129
Tocopherol (*see* **Vitamin E**)
Tolbutamide (*see* **Drugs**)
Toxicity
acetylated fats, 317
allithiamine, 336
aluminum, 23
aminopterin, for the embryo, 248
aspirin, in treatment of diabetes, 167
azaserine, on embryo, 248
cholesterol plus fatty acid mixtures, 186
desoxycarnitine, for the chick embryo, 214
diazo-5-oxo-2-norleucine (DON), for intestinal mucosa, 248
erucic acid, 245
fat emulsions, for parenteral feeding, 164
fluoride
for the skeleton, 277
long term effects, 117
hydrazides, for brain tissue, relation to γ-aminobutyrate metabolism, SA161
lead, aminoaciduria in, 39
lysol, aminoaciduria in, 39
maleic hydrazide, 217
mercaptopurine, 248
methionine sulphoxide, 87
N-methyl-formamide, for liver, 248
nitrogen mustard, for the embryo, 248
raw soybeans, 242
selenium, 174
serotonin, 347
thioguanine, 248
vitamin D, relation to atherosclerosis, N159
vitamin D_2, aminoaciduria in, 39
Trace Elements
aluminum, biological role and toxicity, 23
copper
deficiency in sheep, 78
in high versus low extraction flour, 144
in plasma, changes in Wilson's disease, 37
fluorine
effect of toxic levels on skeleton, 277
treatment of water, long term effects, 117
iodine
passage through placenta, 52
thyroid uptake, relation to diet, 19, 179
manganese, in high versus low extraction flour, 144
molybdenum, relation to copper nutrition, 78
requirements, for tissue culture, SA321
selenium, relations with vitamin E and Factor 3, 149, 174, N319
Transamination
activity, in protein deficiency, 216
mechanism of glutamine utilization in protein synthesis, 157
Trans-Sulfuration
role of pyridoxine in, 178
Trypsin Inhibitor
in raw soybeans, 242
Tryptophan (*see* **Amino Acids**)
Turkey
feather pigmentation in, need for lysine in, 50
nation of, nutrition survey in, SA193
Tyrosine (*see* **Amino Acids**)

Urea
clearance test, effect of long term ingestion of fluoride on, 117
determination of body water, evaluation, 199
dietary, effect on proteinuria in rats, 337
Uric Acid
in urine
in amino acid deficiencies, N287
in Wilson's disease, 39
Urine
excretory routes for calcium, in man, N62
Utilization
bacterial proteins, by ruminants, 115
biotin, by bacteria, effect of Tween and unsaturated fatty acids on, 116
carbohydrate, by HeLa cells, in tissue culture, SA321
food, for growth, efficiency, 279
iron, effect of dietary ascorbic acid plus vitamin E on, 113
lower fatty acids, by ruminants, 207
magnesium, in calves, 173
methionine, in chicks, genetic differences in, 241
protein, plant versus animal, 220
sorbitol, in thiamine deficiency, 126

Valine (*see* **Amino Acids**)
Vegetable
goitrogens in, 19
intake, self-selection by soldiers, 77
oils, essential fatty acids in, SA33
production, dependence on insect control, SA289
proteins, biologic value, comparison with animal proteins, 220
soybean
dietary, effect on iodine uptake by thyroid, 179
protein, efficiency ratio, 56
raw, growth-depressing properties of, 242
Vitamin A (*see also* **Carotene**)
deficiency, lipid and carbohydrate metabolism in, 17
intake, of Cuban children, 271
nutrition, in foreign armed forces, SA193
role in metabolsm, 17
Vitamin B_6 (*see* **Pyridoxine**)
Vitamin B_{12}
biological half-life, 325
blood level, in pernicious anemia treated with intrinsic factor, 235
levels in cytochemical fractions, 252
metabolism
effect of intrinsic factor on, 307
in liver disease, 230
role in protein synthesis, 252

stimulation of appetite in children, N287
treatment of idiopathic steatorrhea, 234
Vitamin B Complex
in human milk, 44
Vitamin D
administration, effect on magnesium deficiency in cows, 173
deficiency, in the cat, 140
effect on blood cholesterol level, N159
effect on bone and blood citrate levels, 247
effect on calcium absorption, 148
effect on mast cells in bone, during rickets, 92
effect on renal clearance of calcium, 205
provitamin D, occurrence in animal tissues, 16
Vitamin D_2
effect on blood cholesterol level and lipoidosis in experimental atherosclerosis, 274
Vitamin E
dietary, effect on blood cholesterol level, 68
effect on hemoglobin synthesis, 113
in high versus low extraction flour, 144
relations with selenium and Factor 3, 149, 174
Vitamin K
induction of hemolysis by, 323
Vitamins (general)
in rhodotorula yeast, 147
relation to hypercholesterolemia, 274
requirements, for HeLa cells in tissue culture, SA321
sparing action of sorbitol, 126

War
food shortages in, incidence of diabetes in Japan, 273
Water
aluminum content, 23
availability, relation to amount of food consumed, 53
balance, changes, in chronic infantile malnutrition, 99
body
determination, evaluation, 199
of horses, species differences in, 14
consumption
control by hypothalamus, 302
effect on proteinuria in rats, 337
of children, N191
relation to environmental temperature, 237
content, of tissues, relation to food intake, 53
fluoridated, long term ingestion of, 117
requirements
of camel, 12
of children, in hot weather, N255
treatment of barley, effect on nutritional value, 108
Weight
body
gain, in Baganda infants, artificial versus breast feeding, 238
of Cuban children, 271
reduction
exercise as measure for, 228
with liquid formula diets, 292
Wheat
gluten
dietary, role in idopathic steatorrhea, 234
lysine in, availability of, 344
protein, efficiency ratio, 56
sodium in, N159
Wilson's Disease
amino acid excretion in, 39
new hypotheses concerning, 37
Work
performance, relation to nutrition, SA257
Wound
healing, role of ascorbic acid in, 218

Xanthomatosis
experimental, in the rabbit, 211
Xanthurenic Acid
in urine, in infants with pyridoxine deficiency, 10
X-Ray
effect on embryo, 248
evaluation of skeletal age, 101

Yeast
Factor 3 activity of, dependence on selenium in growth medium, N319
factor, for prevention of exudative diathesis in chicks, 174
lysine in, availability of, 344
Rhodotorula, vitamins from, 147
torula cremoris, growth inhibition by aminopterin, N127

BOARD OF TRUSTEES

A. C. BENJAMIN, *President, Junket Brand Foods, Chr. Hansen's Laboratory, Inc.*

*F. G. BOUDREAU, *President, Milbank Memorial Fund.*

WILLIAM T. BRADY, *President, Corn Products Company*

CHARLES S. BRIDGES, *President, Libby, McNeill & Libby*

G. BUITONI, *President, Buitoni Foods Corp.*

*LEROY E. BURNEY, *Surgeon General, U. S. Public Health Service*

*CASON J. CALLAWAY, *Hamilton, Georgia*

*O. C. CARMICHAEL, *Biltmore, North Carolina*

THOMAS P. CARNEY, *Vice President, Research, Development & Control, Eli Lilly and Company*

HAROLD W. COMFORT, *President, The Borden Company*

GEORGE H. COPPERS, *President, National Biscuit Company*

E. B. COSGROVE, *Chairman of the Board, Green Giant Company*

JOHN N. CURLETT, *President, McCormick & Co., Inc.*

WESLEY M. DIXON, *President, Container Corporation of America*

*LEE A. DUBRIDGE, *President, California Institute of Technology*

*CHARLES WESLEY DUNN, *New York, New York*

*CONRAD A. ELVEHJEM, *President, University of Wisconsin*

THOMAS C. FOGARTY, *President, Continental Can Co., Inc.*

EDGAR J. FORIO, *Vice President, The Coca-Cola Company*

*CLARENCE FRANCIS, *New York New York*

DANIEL F. GERBER, *President, Gerber Products Co.*

GEORGE A. GRAHAM, *Secretary-Treasurer, Charles B. Knox Gelatine Co. Inc.*

JOHN A. GRAMMER, *Executive Vice President, Beech-Nut Life Savers, Inc.*

HENRY J. HEINZ, II, *President, H. J. Heinz Co.; President, The Nutrition Foundation, Inc.*

*REV. THEODORE M. HESBURGH, C.S.C., *President, University of Notre Dame*

FRANK C. HILDEBRAND, *Vice President, General Mills, Inc.*

*HERMAN E. HILLEBOE, *Commissioner of Health, State of New York*

*FREDERICK L. HOVDE, *President, Purdue University*

PORTER M. JARVIS, *President, Swift & Company*

RIDGWAY KENNEDY, JR., *Chairman, Abbotts Dairies, Inc.*

*JAMES R. KILLIAN, JR., *President, Massachusetts Institute of Technology, Chairman of Board of Trustees, The Nutrition Foundation, Inc.*

*CHARLES GLEN KING, *Executive Director, The Nutrition Foundation, Inc.*

*GRAYSON L. KIRK, *President, Columbia University*

R. NEWTON LAUGHLIN, *President, Continental Baking Co.*

J. PRESTON LEVIS, *Chairman, Owens-Illinois*

R. G. LUCKS, *President, California Packing Corp.*

W. F. MCLEAN, *President, Canada Packers, Limited*

WILLIAM H. MCLEAN, *President of Chemical Division, Merck & Co.*

HANFORD MAIN, *President, Sunshine Biscuits, Inc.*

ARMAND MAY, *Chairman, American Lecithin Co., Inc.*

OSCAR MAYER, *Chairman of the Board, Oscar Mayer & Co.*

JOHN T. MENZIES, *Chairman, The Crosse & Blackwell Co.*

CHARLES G. MORTIMER, *President, General Foods Corporation, Vice President, The Nutrition Foundation, Inc.*

MILTON C. MUMFORD, *Executive Vice President, Lever Brothers Co.*

W. B. MURPHY, *President, Campbell Soup Co.*

H. EARLE MUZZY, *Vice Chairman, The Quaker Oats Co.*

JOHN C. NAYLOR, *Senior Vice President, Pet Milk Company*

WILLIAM F. OLIVER, *President, The American Sugar Refining Company*

*THOMAS PARRAN, *President, Avalon Foundation*

*MAURICE PATE, *Executive Director, United Nations Childrens Fund*

PHILIP W. PILLSBURY, *Chairman, The Pillsbury Company,*

J. G. PLEASANTS, *Vice-President in charge of Research and Development, The Procter & Gamble Company*

L. RATZESBERGER, JR., *President, The Illinois Canning Co.*

KENNETH H. REDMOND, *President, United Fruit Company*

B. E. RICHMOND, *President, Richmond-Chase Company*

LLOYD E. RIGLER, *President, Adolph's, Ltd.*

LYLE C. ROLL, *President, Kellogg Company*

R. T. RYAN, *Executive Vice President, Welch Grape Juice Co., Inc.*

ELBERT M. SHELTON, *Secretary, The Baker Laboratories, Inc.*

WALTER SILBERSACK, *President, American Home Foods, Inc.*

*SIDNEY EARLE SMITH, *Secretary of State for External Affairs, Canada*

FREDERICK W. SPECHT, *Chairman, Armour & Company*

ALFRED N. STEELE, *Chairman, Pepsi-Cola Company*

W. C. STOLK, *President, American Can Company*

VERNON STOUFFER, *President, The Stouffer Corporation*

L. A. VAN BOMEL, *National Dairy Products Corp.*

HENRY WEIGL, *Executive Vice President, Standard Brands, Incorporated*

F. R. WILCOX, *General Manager, Sunkist Growers*

R. D. L. WIRTH, *President, Red Star Yeast and Products Co.*

H. J. WOLFLISBERG, *President, The Nestle Company, Inc.*

C. I. WOOD, *President, Thomas J. Lipton, Inc.*

HARRY W. ZINSMASTER, *President, Zinsmaster Baking Co.*

HORACE L. SIPPLE, *Secretary*

---

* Representative of the public.

THE NUTRITION FOUNDATION

The Nutrition Foundation was organized by food and related manufacturers in December, 1941, as a sincere expression of their interest in scientific progress and human health. The basic purposes of the Foundation are: (1) the development of a comprehensive program of fundamental research, providing basic information in the science of nutrition; and (2) the support of educational measures that will assist in making the science of nutrition effective in the lives of present and future generations.

The publication of NUTRITION REVIEWS has been undertaken to enable professionally trained people to keep abreast of current progress and to have available an unbiased, authoritative review of the current research literature in the science of nutrition.

The Editorial Staff has been carefully selected so that the publication will merit, in reasonable degree, the confidence of the medical profession and others who work directly with the public in the field of nutrition. The service provided by the publication is distinct from that of an abstract journal, a review for laymen, or an extensive scientific review. Since the reviews as originally prepared by a member of the Editorial Staff are frequently modified by special referees and may be further modified by the Editorial Office in preparing final copy for the press, the Editorial Committee feels that it is preferable not to affix the names of Editorial Staff members to individual reviews. There is thus a high degree of group responsibility on the part of the Editor and Associate Editors.

Signed articles do not necessarily represent the opinion of the Editorial Staff.